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QUEENSLAND.

REPORT ON STANNARY HILLS TIN MINES, EUREKA CREEK, WATSONVILLE DISTRICT, NORTH QUEENSLAND.

(BY J. MALCOLM MACLAREN, B.Sc., ASSISTANT GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

THE HONOURABLE THE MINISTER FOR MINES, BRISBANE.

Geological Survey Office,
Brisbane, 1st November, 1900.

SIR,—I have the honour to hand you herewith Mr. J. Malcolm Maclaren's Report on the Stannary Hills Tin Mines, Eureka Creek, Watsonville.

I have, &c.,
WILLIAM H. RANDS,
Government Geologist.

The Stannary Hills Mines are situated near the head of the Eureka Creek, 10 miles north-west of Watsonville. They are comprised within five leases—Nos. 1403-7—and are spread over an area of half-a-mile wide, by a little more than a mile in length. The "country" is a sedimentary rock, composed of highly inclined micaceous and felspathic sandstone, and dark green slaty shales and greywackes. The general strike of the strata is from north-east and south-west to east and west, and the prevailing dip to the north at very high angles, in places closely approximating to verticality.

The tinstone does not occur in fissure lodes with true walls, but as an impregnation along the bedding planes of the green chloritic slaty shales, to which the deposits are almost entirely restricted. The intervening micaceous and coarser felspathic sandstones carry no tinstone, owing probably to the absence of lines of percolation, along which the stanniferous solutions might pass. From the regularity of the dip, and strike of the chloritic shales over the area examined, the permanency of the beds in depth may be confidently anticipated. As to the value of the ore content in depth, there is not yet sufficient data available on which to base an opinion. From the nature of the deposits, however, the value of the "formations" may be expected to fluctuate, both in linear extension and in depth within limits, which can be ascertained only in the course of development.

The details of the various deposits and workings are as follows, the measurements being obtained from personal examination, but the values, where given, are in every case the estimates of the manager, and are appended merely to show the comparative value of the deposits.

Black Rock Hill—Lindsay's Face.—This is an open cut in the north-west portion of lease 1404, in what was originally a green chloritic slaty shale, but which is now oxidised and weathered to a soft, highly ferruginous rock. The dimensions of the cut are 30 feet long by 18 feet wide by 10 feet deep. No dip or strike is revealed by this excavation, which is apparently on the top of the deposit. The ore from this excavation is estimated to carry 2 to 3 per cent tinstone. Seventy feet below the open cut a tunnel has been driven to cut the ore body in depth. This drive is in 75 feet, and in the last 3 or 4 feet of driving a ferruginous leader, which possibly marks the north-west boundary of this deposit and which strikes east and west, has been cut.

The Lord Beauchamp.—This is an ore body which has been trenched across both on the eastern and western slopes of the Black Rock ridge. It is about 70 feet wide containing rich patches, but in bulk is low grade, carrying 2 to 3 per cent. of tinstone.

Extended Workings.—These are to the south-east of the above and comprise several ore bodies. The best defined of these are the Lord Lamington and the Lord Tennyson, which are in chloritic shales and probably strike with the country. They are separated by a barren bed of felspathic sandstone. The former is trenched across for about 30 feet, and the latter for about 70 feet. Both contain rich patches of ore but are on the whole low grade.

The Lord Roberts Shaft is sunk to the north-east of the Old Extended workings to a vertical depth of 120 feet, and from the bottom a crosscut is being driven to get back under the old stopes. The ore body worked in the upper levels from this shaft is very irregular, and in the absence of the assistance given by hanging and footwalls it is difficult to say where it will be picked up in the cross-cut from the bottom of the shaft. This, however, is a problem that, from the nature of the deposits, will frequently confront the management in future exploitation—at any rate, until sufficient development has been done to enable rules to be deduced for future guidance. My own opinion, in the absence of the above data, is that the general dip of the ore bodies will be with the "country"—viz., to the north.

C. A. 105—1900.

The Lord Kitchener Shaft, about 3 chains further to the south-east, is about 66 feet deep, and is sunk from the end of a drive about 40 feet into the side of the hill. Sinking in this shaft is now about to be discontinued, in order that crosscuts may be driven either way to test the width of the ore body, no walls being visible at present. The tin stone is here disseminated throughout a close-grained slaty shale, and is estimated to average 6 per cent. to 7 per cent. throughout.

The whole of the ore bodies above described offer exceptional facilities for economical working, levels driven in from the Eureka Creek giving from 250 feet to 300 feet of "backs."

Ivanhoe and Eclipse Section.—Dixon's Lode. This is an ore body in the bed of Eureka Creek, on the boundary of Leases 1403 and 1404. It is opened up by a cut on the bank of the creek. The "country" is a hard, close-grained, green, chloritic slaty shale, striking east and west, and dipping to the north at very high angles.

Four chains further down the Eureka Creek are the Monarch Workings. These are a tunnel from an open cut, and a shaft 50 feet below the tunnel, and a total distance of 100 feet from the surface. The ore body at the bottom is about 3 feet wide, and is estimated to be worth about 10 per cent. of tin stone. The gangue is here much coarser than on the Black Rock and Extended, approximating closely to a felspathic sandstone.

Opposite to the Monarch and to Dixon's is the most important section of the property—the Ivanhoe and Eclipse Hill. The main shaft (the Rebecca) is about 200 feet in depth, and the surface plat is about 100 feet above creek level. The lower 100 feet of this mine was flooded at the time of my visit, as the manager considers that the mine is now sufficiently proved for all development purposes, and is unwilling to incur unnecessary expense in pumping, and raising ore which will not be treated until the erection of the company's crushing mills. The shaft is 7 feet 9 inches by 4½ feet in the clear, and is centred for winding and for pumping and travelling compartments. An adit level has been driven from the bank of the creek to the shaft—a distance of about 150 feet. The shaft has been sunk in a "pipe," about 43 feet long by 16 feet wide. Down to the 100 feet (or adit) level it was worth 8 per cent., and below the adit it is estimated to be worth 13 per cent.

The Baden-Powell Shaft has been sunk at a point where the Ivanhoe and Eclipse ore bodies apparently junction, and is 70 feet in depth. This shaft has been stopped owing to the accumulation of water in the Ivanhoe workings. The bottom of the shaft is not on the ore body, but is probably in a "horse," as the Ivanhoe body is only 5 feet to the north as proved by bore holes.

The Ivanhoe and the Eclipse both form the caps of small spurs, the former striking E.S.E., and the latter E.N.E. To the north the "country" is a micaceous sandstone.

The Buller Shaft has been sunk on the Eclipse ore body to a depth of 91 feet. At the bottom of the shaft the ore body is 14 feet wide, and is estimated to average 20 per cent.; of this 14 feet about 7 feet is of much better quality than the remainder, and should average 40 per cent. The ore body has fairly well-defined walls which are probably bedding planes in the country rock. It is approximately vertical, and appears to strike east and west. The gangue is highly mineralized, carrying iron pyrites with small quantities of zinc-blende, galena, and chalcopyrite. This body has been exposed for a length of 20 feet by a width of 14 feet and a height of 20 feet.

Cudmore's Tunnel is about 700 feet to the south-west of the Buller Shaft. A puggy ore formation has been struck after driving about 35 feet and sinking 6 feet to 7 feet. This decomposed kaolinic rock carries rich patches in places. The tunnel is only about 18 feet below the cap of the ridge.

The Lady Mary strikes east and west and forms the spur of a small ridge running down into the Eureka Creek. A shaft (Phillips') is being sunk on the ore body, and is 20 feet in depth.

Hornets' Nest Section.—The workings on this section lie to the south of the manager's house, and comprise three main ore bodies. The most southerly is the General White, upon which a shaft has been sunk 80 feet deep. The "formation" is 3 feet to 4 feet in width. On the Middle Lode a shaft of 50 feet in depth has been sunk, revealing an ore body 10 feet wide. From an open cut, 12 feet by 10 feet by 6 feet, a fire assay returned 7 per cent.

The General French Shaft is 70 feet deep, and is in an ore body 6 feet to 8 feet wide. This appears, however, unlike all the others mentioned, to strike north and south, and may, indeed, be an impregnation along connecting joint planes. Crosscuts, each 25 feet long, driven north and south, failed to discover other than low-grade lode matter.

In all the above sections the surface deposits are highly stained, and in cases even cemented by ferruginous matter. In depth, however, the general characteristic colour of the unaltered rock is a dark green owing to the presence of chloritic matter.

Young Australia and Ironclad are two leases about a mile south-east of the manager's house. The old workings of the Ironclad have not yet been opened up, but a tunnel has been driven along the course of the former lode, for, unlike the deposits on the Eureka Creek, the Young Australia is a fissure lode, with well-defined hanging and foot walls, striking north-west and south-east, and dipping to the north-east at an angle of 70 degrees. The country is here a felspathic sandstone. The lode varies in width from 2 feet to 5 feet. Considerable quantities of tin ore have been taken from old workings on this lode, which is estimated to average 6 per cent. to 7 per cent. The tin stone, again, unlike the ore bodies previously described, is disseminated throughout a gangue of quartz.

As it is the intention, I understand, of the company to abandon Lease No. 1406, on which are situated the Ruby workings, this section was not visited.

The work of development has apparently been systematically and carefully carried out, and the success of the present management augurs well for the result of future operations.

J. MALCOLM MACLAREN.

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147

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QUEENSLAND.

GEOLOGY OF THE WEST MORETON OR IPSWICH COAL FIELD.

(REPORT ON, BY WALTER E. CAMERON, B.A., ASSISTANT GOVERNMENT GEOLOGIST.)

[*With* 2 *Maps*, 4 *Geological Sections, and* 10 *Figures.*]

ALSO

QUEENSLAND COAL: ITS ECONOMIC VALUE AS A STEAM COAL.

[*A Paper read before the Queensland Institute of Mechanical Engineers, December*, 1892, *by Robert Wilson, Engineer, Government Steamer* "*Otter.*"]

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE MINISTER FOR MINES, BRISBANE.

Geological Survey Office,
Brisbane, 22nd May, 1899.

SIR,—I have the honour to hand you herewith Report by Mr. Walter E. Cameron on the Geology of the West Moreton or Ipswich Coal Field, with, as an Appendix, "Queensland Coal: Its Economic Value as a Steam Coal," a Paper read before the Queensland Institute of Mechanical Engineers, December, 1892, by Robert Wilson, Engineer, Government Steamer "Otter."

I have, &c.,
WILLIAM H. RANDS,
Acting Government Geologist.

TABLE OF CONTENTS.

I.—GENERAL GEOLOGY OF THE COALFIELD AND SURROUNDINGS.
1. Introduction.
2. The Faulted Junction of the Ipswich and Gympie Formations.—The Pine Mountain Inlier.
3. The Coal Measures near Ipswich—
   (1) The Basal Conglomerate.
   (2) The Coal-bearing Beds.
4. The Folding and Faulting of the Coal Measures near Ipswich.
5. A Coal-bearing Horizon.
6. Palæontology.

II.—THE NORTH IPSWICH OR TIVOLI AREA.
1. Coals underlying the Worked Seams.
2. The Coal Measures carrying the Worked Seams.
3. The Benley Seam.
4. The Bishop or Big Seam, and the Bishop Fault.
5. The Tivoli Seam and the Tivoli Fault.
6. The Waterstown or Cuffe's Lower Seam.
7. The Fiery Seam or Cuffe's Upper Seam.
8. The Tantivy Seam.
9. The Garden Seam.
10. Future Extension of the Work of Winning the North Ipswich Coals.

III.—THE COAL BEDS AT BLACKSTONE AND BUNDANBA.
1. General Disposition of the Beds.
2. The Coal Beds at Blackstone—
   (1) The Aberdare Seam and Colliery.
   (2) The Aberdare Seam at the West Moreton Colliery and the West Moreton Seam.
   (3) Character of the Aberdare Seam.
   (4) Extension of Work on the Aberdare Seam to the West and North.
   (5) The Bluff or Dirty Seam.
   (6) The Stafford's Four-foot-six Seam.
   (7) Seams below Stafford's Four-foot-six Seam.
3. The Coal Seams at Bundanba—
   (1) The Bræside Colliery.
   (2) Continuation of the Seams North and East of the Day Dawn Colliery.
4. Value of the Lower Coals between Blackstone and Bundanba, and their probable depth below the surface further West.
5. Thickness of the Coal Measures at Blackstone and Bundanba.

IV.—THE COAL BEDS AT SWANBANK AND COONEANA.
1. Continuation of the Seams to the South of Blackstone.
2. The Swanbank Seams.
3. Probable Extension of the Blackstone Seam under Box Flat towards the Swanbank Colliery.
4. Coal Seams to the South and East of Swanbank.
5. Coal Seams on the Cooneana Estate and Adjoining Properties.
6. Stafford's Tunnel Fault.

V.—THE COAL SEAMS IN THE NEIGHBOURHOOD OF DINMORE.
1. General Disposition of the Beds—the New Chum Seam.
2. The New Chum Colliery.
3. The Whitwood Colliery.
4. The Dinmore Colliery.
5. The Ebbwvale Colliery.
6. The Old Aberdare Seam.

VI.—CHARACTERISTICS AND COMMERCIAL VALUE OF THE WEST MORETON COALS.
1. Analyses and Tests, with Tables and Notes.
2. Difference between the coals from North and South of the River—the Walloon Coal.
3. Comparison of Analyses with those from New South Wales.
4. Ash Percentages.
5. Friability.
   Table I.—Analyses of Coals.
   Table II.—Results of Engine Tests of Coals made on the Government s.s. "Otter"; with notes by Robert Wilson, Engineer.

APPENDIX.
QUEENSLAND COAL: ITS ECONOMIC VALUE AS A STEAM COAL.
A Paper read before the Queensland Institute of Mechanical Engineers, December, 1892, by Mr. Robert Wilson, Engineer.

ADDENDA.
I.—Shaft Journals of Aberdare, West Moreton, and Bore-hole Collieries.
II.—Table shewing Output of Coal from the Ipswich Coal Field from 1860 to 1898.

C. A. 100—1899.

I.—GENERAL GEOLOGY OF THE COALFIELD AND SURROUNDINGS.

1. *Introduction.*—The strata in which the coal seams of the Ipswich Coal Field occur are part of a mass of conglomerates, sandstones, and shales, which are known as the "Ipswich Formation," and are estimated to cover an area of about 12,000 square miles in south-eastern Queensland. This formation, from the assemblage of fossil plants found in it, is referred to the Upper Trias-Jura period of time. It is known to contain coal seams at many widely-separated points over this area, though these have been most extensively worked in the neighbourhood of the Town of Ipswich. Ipswich lies about twenty-five miles by rail south-west of Brisbane, on the Bremer River, a tributary of the Brisbane, and navigable for barges and small steamers as far as the town.

The portion of this large extent of coal-bearing beds examined for this report is an area of about fifty square miles in the neighbourhood of Ipswich, embracing all the mines at present working. The coalbeds are bounded to the north of this area by a fault following the course of the Brisbane River about five miles north of Ipswich, by which the coalbeds are brought down against older metamorphic quartzites and schists. These are presumably of Palæozoic Age, and are referred to the Gympie Formation or lower beds of the Permo-Carboniferous System. The boundary line between these two formations is shown on Map 2 accompanying this report, extending from Brisbane on the east to Wivenhoe and Northbrook on the west. In the neighbourhood of Brisbane the Ipswich Beds lie unconformably on the quartzites and schists, but on following the junction of the two formations along the river south of the city it becomes a faulted one, and maintains this character as far west as it has been hitherto followed in detail. Map No. 2 shows also the outcrops of the seams and general strike of the beds in the area worked for coal, and gives the dip of the beds wherever observed outside that area.

The Ipswich Beds, consisting for the most part of lenticularly bedded thin shales and sandstones, often becoming grits and pebbly conglomerates, do not afford any well-defined horizons. They lie mostly in undulating folds, which give the strata dips of up to 15 degrees, or occasionally more in the neighbourhood of faults. They have been denuded into low undulating country south of the Brisbane River, with occasional ridges capped by the harder grits and conglomerates, which stands out in marked contrast to the more rugged country of the metamorphic rocks north of the river. This area of metamorphic rocks is seen as a line of rounded hills from any point of vantage south of the river. Almost at the base of the Ipswich Beds about Brisbane, but separated from the Gympie Beds by a few feet of shale, is a thick bed of volcanic tuff, shown on Map 2 dotted in red. It is lost at the point where the faulted junction of the beds commences, but patches of similar tuffs are found at various points along the junction line. Some of these points are marked on the map.

2. *The Faulted Junction of the Ipswich and Gympie Formations—The Pine Mountain Inlier.*—The faulted junction was traced by the writer from the mouth of Pullen Creek on the east to Wivenhoe and Northbrook on the west. The information on Map 2 east of this has been compiled from information collected by various officers of the Geological Survey and placed on record on the office maps. As noticed before, the faulting commences at a point on the Brisbane River, south of the city, in the neighbourhood of Yeronga, where the basal tuff which east of this lies unconformably on the older slate and quartzites is here cut out. The fault extends west from this point in a zigzag course as far as the Pine Mountain. Here the trend of the fault takes a turn to the N.W. and runs in a gently curving line bounded to the N.E. by steep hills of Gympie Rocks as far as the boundary of the map.

At the point where the junction line crosses the Brisbane River, just above its junction with the Bremer, it is obscured by basalt, which intervenes between the two formations. This basalt is exposed on the river bank where it is quarried for road metal. The basalt has evidently been extruded along the fault as a line of weakness, and has overspread both formations for some distance on each side. A similar occurrence of the basalt is found south of the Mount Crosby Pumping Station, and again near the mouth of Oaky Creek, in the Parish of Sahl. The fault is distinctly exposed on the river bank at the latter point, the sandstones and shales of the Ipswich Formation with a bed of interstratified tuff dipping away from a steep hill of quartzite on the north, from which they are separated by a narrow dyke of basalt. The contact of the two formations is still more distinctly exposed to the north of, and lower down the river than, Kholo Bridge, where conglomerates of the Ipswich Formation are found on the river bank lying on the face of a quartzite bluff, the fault here hading west at about 45 degrees.

The elevated ridge known as the Pine Mountain, situated near the southern bank of the Brisbane River, about six miles to the north of Ipswich, together with the country to the west of it as far as the road to Marsh's Crossing past the school, forms a detached mass of Gympie Rocks, which has been faulted away from the main mass to the north, and constitutes a faulted inlier of these beds surrounded on all sides by conglomerate beds of the Ipswich Formation. The elongated summit of the Pine Mountain ridge strikes N.N.W. in conformity with the strike of the Gympie Beds for a distance of about a mile, and consists of light yellow and brown quartzite. Immediately west of it is a belt of softer ferruginous quartzite which has been exploited as an iron ore. Mr. Rands visited this locality in 1894, and reported unfavourably on the quality of the stone as an ore of iron, the stone being found to contain

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too much silica to be of any commercial value.* West of this belt of ferruginous quartzite is one of serpentinous schist with associated chrome iron ore with the prevailing N.N.W. strike, which terminates on the west in the ridge lying to the north of the school. A parcel of this ore sent to the Government Analyst for analysis on 20th March, 1898, gave the following analysis:—

Chromium oxide, Cr_2O_3, 36·89 per cent.
Ferrous oxide, FeO, 13·12 per cent.
Alumina, Al_2O_3 4·16 per cent.
Magnesia, M_gO, 25·58 per cent.
Lime, CaO, *nil.*

3. *The Coal Measures Near Ipswich*—(1) *The Basal Conglomerate.*—The lowest beds of the Ipswich Formation seen in the neighbourhood of the coalfields are exposed along the faulted junction on the north for a distance of about nine miles in the banks of the Brisbane River from Fairney View on the west to Colledge's Crossing on the east. They consist mainly of a mass of coarse conglomerate. Thin sandstones and shales are exposed interbedded with these conglomerates in the river sections, and tuff, apparently interbedded, was found at various points, but was nowhere seen in the natural sections, though some must be at least 200 feet in thickness. The conglomerates consist of well waterworn pebbles and boulders set in a sandstone matrix. They form rough hills along the southern bank of this portion of the Brisbane River, and are exposed as steep bluffs, where they are cut into by the river. Their base is nowhere seen, as they abut against the Gympie Beds to the north, their junction being well exposed at several points where the river crosses it. At a steep bluff on the south side of the river, opposite Fairney Creek, and again on the north side of the Pine Mountain, this conglomerate consists of large boulders of quartzite of various colours, evidently derived from the degradation of the Gympie Beds, and no doubt representing a shore formation of shingle broken down by an advancing sea eating into cliffs of the older Gympie Rocks.

The area covered by the conglomerate is shown on Map 2. It is there seen to extend east to beyond Colledge's Crossing with a gentle dip to the S. by E. and a consequent N. by E. strike. This strike, together with the cross faulting, shown east of Colledge's Crossing, cuts out the conglomerate which is here faulted down out of sight against the Gympie Beds, while higher beds are brought down against the older rocks. West of the Pine Mountain the conglomerate is found dipping steeply S. 60 degrees W., being bent over suddenly to the west on an axis running in a south-easterly direction. This bending of the beds not only affects the conglomerate, but all the higher coal-bearing beds. Its effect on the strike of the overlying coal beds can be traced in a S.E. direction as far as the south of Ipswich and is shown by the strike lines on the map.

This bending over of the beds causes the conglomerate to lie almost perpendicularly against the western side of the Pine Mountain Inlier. North of the mountain it is again cut out by the cross-faulting shown on Map 2 at Fairney Creek, being also on this side faulted down out of sight, the overlying sandstone and shales being thus brought down against the Gympie Beds. Patches of conglomerate are found at various points along the faulted junction north of Fairney Creek, and may very possibly be a continuation of the same basal beds left here and there at the surface by the faulting.

(2) *The Coalbearing Beds.*—Above the basal conglomerates between the Brisbane and Bremer Rivers the next lowest members of the Ipswich Formation are seen, consisting of lenticularly bedded pebbly conglomerates, grits, sandstones, and sandy and argillaceous shales, with their accompanying beds of coal. Map 1 shows the strike of these beds as indicated by the outcrops of the coals north of the Bremer, where they dip at about 15 degrees to the S.E. The dip increases towards the west as the strike lines cross the Bremer River at Ipswich, till the beds are bent sharply over to the west in the same manner as the underlying conglomerate.

Over a large area in the centre of the field the coal beds are hidden by alluvial deposits along the south bank of the Bremer, and also by the large area of basalt overlying them between Ipswich and Bundanba. They are found again carrying workable coals to the south and east of the basalt and alluvium between Bundanba and Six-mile Creeks, where they are domed up about an apex lying about half-way between the two, the beds dipping away at angles of generally about 15 degrees. East of Six-mile Creek the coal beds are in more gentle folds affording fewer exposures of the seams, and consequently the lines of strike are more difficult to map.

The peculiar and comparatively severe folding of the beds near Ipswich appears to be due to the differential movement of the beds caused in the faulting against the Gympie Rocks.

With its change in direction in the neighbourhood of the Pine Mountain the faulting apparently becomes much greater in amount. This is evidenced by the disappearance of the basal conglomerates to the N.W., and the bending over of the Ipswich Beds, the upturned edges of a great thickness of strata being exposed on the western side of the axis of folding as shown by the strike lines on the map. By this bending over of the Ipswich Beds strata of considerably higher horizons are brought in and occupy the district from Walloon to Fernvale, where the Ipswich coal beds are probably lying at a considerable depth below the surface. As far as the few exposures observed give any indication, the strata over this area are practically horizontal, and it would be an interesting and important question to determine whether the coal-bearing horizon of Ipswich lies at workable depths over any portion of it.

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* Annual Progress Report of the Geological Survey for the year 1894, page 27.

4. *The Folding and Faulting of the Coal Measures near Ipswich.*—The most southerly point at which the highly-inclined beds can be seen near the town of Ipswich is along the Bremer River from the One-mile Bridge up, where they are found dipping at increasing angles to the west, till at a sharp bend of the river the dip is from 70 degrees to 80 degrees. (See Map 1.) West of this the rocks are hidden under an accumulation of black soil, which is apparently river alluvium. At the bridge the rocks are apparently faulted, and the bending round can be observed on passing up Deebing Creek, where the dip swings round to south at 22 degrees.

The change of dip can also be well observed on following the Toowoomba Line out from Ipswich. In the first cutting it is S.E. at high angles ; further on the lie of the beds is obscured, and there is apparently faulting. At a quarry south of the line on the Saddler's Pocket Road it is 50 degrees to S. 60 degrees W.; near the Sadler's Crossing Bridge it is still steeper; in the bed of the river it is about 15 degrees, while in the first cutting over the river the dip is about 80 degrees, still in the same direction.

The westerly dipping beds are again well exposed on following up Poninerudda Creek, where the dip varies from 30 degrees to perpendicular between its junction with the Bremer and where the beds are hidden under the area of basalt towards its source. On the banks of the river at this junction faulting has again taken place, and also further west near the edge of the basalt.

Further north, between the Waverly and Pine Mountain Roads, an escarpment of coarse grit and conglomerate dips at 60 degrees to S. 60 degrees W., and north of the area of basalt near the Pine Mountain the same dip is observed.

It is impossible to estimate what thickness of strata would be passed over in a traverse across the outcrop of these westerly dipping beds as the dip is so variable in amount, and the highest of the beds is nowhere exposed. Taking the distance across the outcrops north of Poninerudda Creek at 100 chains, and the average dip at 60 degrees, we get 5,700 feet as probably a very low estimate of the thickness of strata exposed above the basal conglomerate. Further west from Karrabin to Walloon and to the N.E. and S.W. of that place softer sandstones and shale are found dipping gently to the S.W. as far as can be judged by the rare exposures seen over this area. Near Walloon a shaft reaches coal dipping at 3 degrees in this direction. These beds consequently must as stated before be on a much higher horizon than those carrying the coal to the east and north of Ipswich. The coal itself is of a different character having a lower specific gravity, and a brighter lustre. It shows conchoidal fracture, does not soil the fingers, and gives a much higher percentage of hydrocarbons.

Several faults of considerable throw have been disclosed by the mine workings around Ipswich. A study of these on the map shows that they run generally in a N.W. and S.E. direction, parallel with the axis of folding of the Ipswich Beds, with a downthrow to the N.E. They have no doubt been caused by the same movement which resulted in the folding of the beds. They would almost seem to be continuous from the north of Ipswich to the east of Ipswich as indicated by the broken lines on Map 1. The line of the West Moreton Fault south of Blackstone, drawn from the plans of the mine, when produced in a N.W. direction is seen to coincide almost exactly with that of a fault exposed in the first cutting on the Tivoli Railway Line at North Ipswich ; while those of the Tivoli and Bishop Faults to the N.E. of the latter, when continued to the south are seen to coincide roughly with those of faults found at Bundanba and Dinmore.

The section along the line A.B. on Map 2 shows the relation of the Ipswich to the Gympie Beds at the Pine Mountain.

The section at the base of the map gives the general disposition of the beds on a line east and west from Ipswich to Bundanba, and shows the sharp folding over to the west of the town with the probable faulting between Ipswich and Walloon.

5. *A Coal-bearing Horizon.*—It will be seen from the information given in the following pages that the coal seams of the West Moreton Field and the beds in which they lie are inconstant in character, and are considerably folded and faulted, not only rendering their mining difficult, but rendering also the prediction from geological evidence of their existence in a workable condition at points even a short distance from where they are proved a matter of great uncertainty. A glance at the maps shows that they have been most extensively worked, where, owing to the greater folding of the beds and the more broken contour of the land surface, the outcrops of the seams have been best exposed. Their accessibility from points of intercommunication has no doubt also been a determining factor. There almost seems to be a *par excellence* coal-bearing horizon represented by the six or seven seams shown on Map 2, outcropping at North Ipswich, and the half-dozen or more seams outcropping between Blackstone and Bundanba, though there is really no evidence to show that the seams in these two localities are on the same horizon. This horizon, if we accept it as one till further development has shown otherwise, has been, as stated before, most thoroughly prospected at the above localities, but it scarcely seems possible that it affords workable coal only in these localities. Following this horizon at North Ipswich to the east the coal apparently deteriorates in quality. The coals in this direction, however, cannot be considered to have been thoroughly tested. Following the same horizon to the west, some of the coals have been worked up to

the eastern bank of Mihi Creek and across the river, but further west the beds are suddenly bent over, and the coal-bearing horizon does not appear to have been prospected along this north-westerly strike. At Blackstone again, following the strike of this coal-bearing horizon to the south, prospecting work has shown seams to occur as far south as the southern bank of Oaky Creek, and it is very probable that further development in this direction will show that these seams are a continuation of the same horizon. Following the horizon to the north, the beds are bent over, and, though considerably faulted and disturbed, in all probability the same horizon is represented by the New Chum, Old Aberdare Seam, and underlying seams in the neighbourhood of Dinmore, and to the east by those seams found on Cooneana and to the east of Six-mile Creek. The folding of the beds probably brings this horizon to great depths below the surface over large areas in the neighbourhood of the present known outcrops, but there must still be a considerable area over which the seams occurs at workable depths, as is shown more particularly later on. Very little but surface prospecting has been done away from the present mined ground, so that it is almost impossible to say what fresh seams will be discovered when increased demand will have stimulated a more thorough search, and rendered necessary boring with the calyx or other drill in order to prove the coal at greater depths from the surface.

6. *Palæontology.*—The following list of fossils found in the Ipswich Beds, in South-Eastern Queensland, is taken from Mr. Jack's list in the "Geology of Queensland,"* page 362:—

SUB-KINGDOM—PLANTÆ.
CRYPTOGAMIA.
Equisetum rotiferum, Ten. Woods
,, (?) *latum*, Ten. Woods
Phyllotheca carnosa, Ten. Woods
,, (sp. ind.)
Vertebraria equiseti, Ten. Woods
,, *towarrensis*, Ten. Woods
Sphenopteris Baileyana, Ten. Woods
Trichomanites laxum, Ten. Woods
,, *spinifolia*, Ten. Woods
,, *elongata*, Carruthers
Thinnfeldia odontopteroides, Morris
,, ,, var. *falcata*, Ten. Woods
,, *media*, Ten. Woods
Alethopteris australis, Morris
,, *Lindleyana*, Feist.
Gleichenia lineata, Ten. Woods
Tæniopteris (? Angiopteridium) Daintreei, McCoy
,, *(? Angiopteridium), Carruthers*
Phyllopteris Feistmanteli, Eth. fil.
Macrotæniopteris wianamattæ, Feist.
Macrotæniopteris crassinervis, Feist.
Sagenopteris rhoifolia, Presl.
,, *? cuneata*, Carruthers.
Phlebopteris alethopteroides, Eth. fil.
PHANEROGAMIA.
Podozamites lanceolatus, Lindley and Hutton.
Otozamites mandeslohi, Kurr.
Pterophyllum abnorme, Eth. fil.
,, (sp. ind.)
Ptilophyllum oligoneurum, Ten. Woods.
Araucarites ? polycarpa, Ten. Woods.
Sequoites ? australis, Ten. Woods.
Taxites medius, Ten. Woods.
Brachyphyllum crassum, Ten. Woods.
Cunninghamites australis, Ten. Woods.
PLANTÆ INSERTÆ SEDIS.
Cardiocarpum ? australe, Carruthers.
Cycadinocarpus.
ANIMALIA.
Estheria mangaliensis, Jones.
Mesostigmodera typica, Eth. fil. and Olliff.
Unio ipsviciensis, Eth fil.
,, *eyrensis*, Tate.

Since this list was published, the following new species from the Ipswich Beds, many of them from Denmark Hill, Ipswich, have been described by Mr. Shirley, in his "Additions to the Fossil Flora of Queensland," No. 7 of the Geological Survey Bulletins:—

Sapindus oxleyensis, Shir.
Cinnamomum primigenium, Etting.
Ficus subsycamorus, Shir.
Myrica subsalicina, Shir.
Ginkgo antartica, Sap.
,, *bidens*, (Tenison-Woods), Shir.
,, *Simmondsi*, Shir.
,, *phœniciformis*, Shir.
Baiera ipsviciensis, Shir.
,, *ginkgoides*, Shir.
Stachyopitys annularioides, Shir.
,, *Simmondsi*, Shir.
Pterophyllum parvum, Shir.
,, *yerongense*, Shir.
,, *multilineatum*, Shir.
,, *quadrifilornm*, Shir.
Beania geminata, Shir.
Lygodium antiquorum, Shir.
Scolecopteris australis, Shir.
Todea australis, Renault.
Sphenopteris delicatula, Shir.
,, *superba*, Shir.
Sphenopteris walchiformis, Shir.
,, *lacunosa*, Shir.
,, *Baileyana*, Ten.-Woods.
Trichomanites spinifolia, Ten.-Woods.
Triphyllopteris botryoides, Shir.
Neuropteris punctata, Shir.
Alethopteris Lindleyana (?), Feist.
Thinnfeldia indica (?) Feist.
,, *odontopteroides*, Feist.
,, *(Gleichenia) dubia*, Feist.
Pecopteris queenslandiæ, Shir.
,, *subtenera*, Shir.
Tæniopteris Tenison-Woodsi, Eth. fil.
,, *(Angiopteridium) spatulata*, McClell.
Tæniopteris (*Angiopteridium*) *Etheridgei*, Shir.
Oleandridium lenticulariforme, Eth. fil.
Sagenopteris rhoifolia, Presl.
Phlebopteris (?) *dichotoma*, Shir.
Dictyophyllum bremerense, Shir.
Calamostachys australis, Shir.
Equisetides moretonensis, Shir.

II.—THE NORTH IPSWICH OR TIVOLI COAL AREA.

1. *Coals Underlying the Worked Seams.*—Between the basal conglomerate along the Brisbane River and the lowest worked seam in the North Ipswich Area is a considerable thickness of carbonaceous and sandy shales with thin sandstones and conglomerates. Their thickness, estimated from their breadth of outcrop along the Mount Crosby Road and their average dip, must be about 700 feet. They contain several thin seams of coal that have been opened up at various points, but none of which have so far proved of workable thickness. For some distance along the bed of Sandy Creek, which cuts across the outcrops between the Brisbane and Bremer Rivers, about 12 feet of thin coal and black carbonaceous mudstones or shales are exposed dipping south at 15 degrees, and these have been opened up by a tunnel (in Portion 181, Parish of Chuwar) near the road. The tunnel exposes about 8 feet of stone and coal bands, the thickest band of clean coal being about 8 inches. The outcrop of this seam is shown on Map 2. Another and apparently lower seam is exposed on the bank of the Brisbane River at the intake

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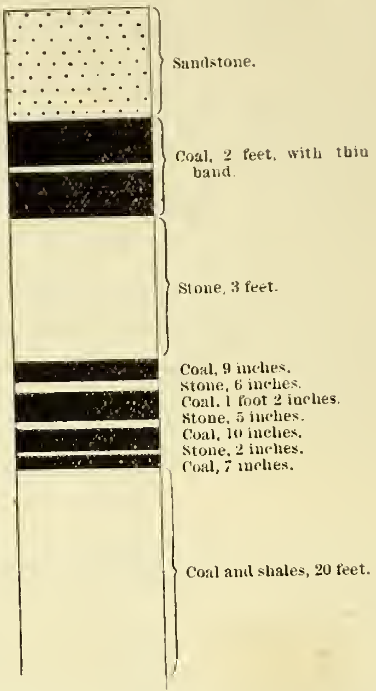
* Brisbane: By Authority, 1891.

of the Ipswich Waterworks, showing about 30 feet of thin coals and coaly shales dipping south at about 10 degrees. Fig. 1 gives a section of the uppermost coaly strata.

Fig. 1.



Section of Coal Strata in River at Ipswich Waterworks.

Below are alternate thin coal and shale, with a 1 foot 4 inch band of coal near the bottom. The coal is bright and soft. The same coals are seen in the gully north of the pumping station, dipping east at 30 degrees; and the strike of the beds can be followed for some distance to the west.

The following reference to this coal is quoted by Mr. Jack from a report by Mr. (now the Hon.) A. C. Gregory*:—

"Two miles north-west from the Tivoli Mine a large coal seam is exposed on the bank of the Brisbane River just above the Rocky Crossing. The total thickness of the seam is nearly thirty feet, but so full of bands of shale that only three feet of the lower part could be worked, and even that of such inferior quality that it would be of little value as fuel. A specimen from the best part of the seam gave the following results:—

Volatile in coking	22
Fixed carbon	51
Ash	27
	100
Specific gravity	1·47"

Other thin seams of coal have been found in this series of strata between the conglomerate and the lowest worked seam, but none of them have as yet given sufficient inducement to warrant any expense being incurred in testing their value. Seams up to four feet in thickness are reported to have been opened up on Portion 88a, near Kholo Bridge, evidently on about the same horizon as that at the Ipswich Waterworks, immediately above the conglomerate, and probably a continuation of the same coal.

It is quite possible that such a considerable thickness of shale containing numerous coals will yet afford some workable seams when they are more thoroughly prospected.

2. *The Coal Measures Carrying the Worked Seams.*—Practically, the whole of the coal in this area has been obtained from the outcrops of the seams from between Mihi Creek on the west to a little east of Sandy Creek, over an area of about three miles along the outcrops by about a mile and a-half across. The outcrops of seven seams, all of which have been worked for coal, are shown on Map 1, dipping under the Bremer River to the S.E. The perpendicular distance between the lowest and uppermost worked seams—the Benley and the Garden Seams—is about 900 feet. The coals occur in groups in sandy and carbonaceous shales, separated by beds of sandstone and pebbly conglomerate. These harder strata can be traced for considerable distances, and are shown by the coarser shading on the map. The continuity of the seams is broken by two large parallel faults running in a N.W. and S.E. direction with downthrows to the N.E., known as the Tivoli and Bishop Faults, from the mines in which they were first observed. Another parallel fault with the same downthrow is exposed in the first cutting on the Tivoli Railway Line.

Fig. 7 gives a vertical generalised section of the strata from the basal conglomerate to the bed of sandstone overlying the Garden Seam. The vertical distances are estimated from the distances between the outcrops and the average dip of the beds, the distance from the Tivoli Seam to the Tantivy being corrected by the depths at which these seams are found in the Waterstown Shaft.

The coal is almost entirely obtained by adits from the outcrops of the seams, from which levels are then driven to right and left, rooms being broken off from the levels with pillars of from 8 to 10 feet between. The only vertical shafts at present working are the Waterstown Shaft, which reaches the Tivoli Seam at a depth of 570 feet, and at a distance of about 900 yards from its outcrop, and the Haighmoor Shaft, which works a seam at 135 feet in depth. No other seam in the North Ipswich Area has been worked to a distance of more than 600 yards from its outcrop. The average dip of the coals varies from about 10 degrees on the east to 20 degrees on the west, and this dip has the effect of bringing the seams to a considerable depth below the surface, within a short distance from the outcrop.

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* "Palæontology of Queensland and New Guinea," Jack and Etheridge, p. 337.

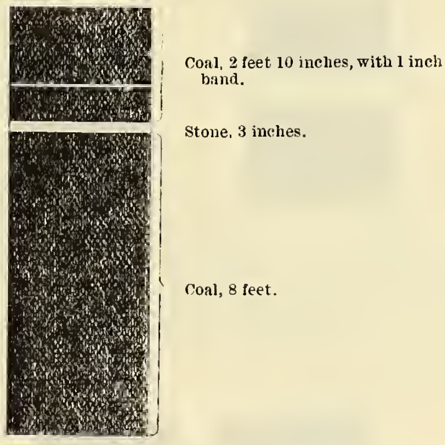
Below follows a short description of each seam, beginning with the lowest and working upwards:—

3. *The Benley Seam.*—The Benley Seam, the lowest seam worked north of the river, is at present worked by a tunnel on Portion 131, by Mr. George Ware, of Ipswich, where it dips at 10 degrees to the south-east. It shows 4 feet 3 inches of workable coal with 6 inches of stone. The coal is intermixed with a good deal of sandy material. The seam is overlaid by about 10 feet of shale, above which Mr. Harris, the Manager, tells me are another 3 feet of workable coal. Below are 5 feet of sandstone and thin coals, under which are another 4 feet of workable coal. The middle seam is the only one at present worked. Across the road to the west of this portion at the head of a gully a seam of coal has been exposed which is apparently the same seam. In Portion 177, Morris has driven a tunnel into a seam which occupies approximately the same horizon as the Benley Seam. It shows about 2 feet 3 inches of bright coal with bands of stone, and dips at about 10 degrees to S. 10 degrees E.

4. *The Bishop or Big Seam and the Bishop Fault.*—This seam lies from about 100 to 150 feet above the Benley Seam, the intervening strata being mostly sandstone. It was worked over a considerable area by Mr. Wright from the Eclipse and Bishop Tunnels in Portions 63, 65, and 66, till the mine was destroyed by the falling in of the workings during the flood of 1893. It is at present worked to the level of the water now standing in the Bishop Tunnel. In the levels going north-east in the latter mine the coal was lost at continually increasing distances from the tunnel as it was extended downwards, the levels coming up against a wall of sandstone brought down by a fault which cuts off the coal and throws it down to the north-east. The effect of this fault is seen on the surface near the tunnel by the bending up on edge of the outcropping sandstones. It is the Bishop Fault referred to previously.

The seam is again found to the north-east of this fault at the Nil Desperandum and Donnybrook Mines in Portions 130 and 127, respectively, the former of which at one time sent out a considerable quantity of coal. The dip here is a little south of east at about 10 degrees.

Fig. 2.



Section of the Bishop Seam, Donnybrook Mine.

The working in both these mines was put an end to by the influx of water from the adjoining creek. The levels to the south-west in the former mine were driven till they met the fault found in the Bishop Tunnel. A tunnel driven through the fault on the south of Sandy Creek, near the College's Crossing Road, met the Waterstown Seam on the southern side of the fault. The fault can be seen on the surface on the same road immediately south of the creek. Its position accordingly is fairly accurately defined by the fact of its having been encountered at the above three points.

The outcrop of the Bishop Seam is again seen in the bed of Sandy Creek on the Mount Crosby Road, and can be traced along that road for some distance by the accompanying shales till it swings off to the right across to College's Crossing Road. It has not as yet been worked east of Sandy Creek.

The levels from the Eclipse Tunnels to the south also broke up against a fault—the Tivoli Fault—near the southern boundary of Portion 66, by which the beds are thrown up to the south-west, and the same seam was worked from a tunnel in Portion 68, and also from the old Tivoli Shaft on the same portion, which met the seam at about ninety feet from the surface. It has recently been opened up by Messrs. Stafford Bros. by a tunnel near the southern corner of Portion 69. The outcrop of the seam can be traced across the road till it is lost under the alluvium of Tivoli Creek. Apparently the same seam is found on the west side of the creek, and can be more or less certainly traced by the accompanying sandstones and shales to the Eastwood Tunnels, on the banks of Mihi Creek.

These workings have long been abandoned. They are thus referred to by the Hon. A. C. Gregory, as quoted by Mr. Jack on page 336 of "The Geology of Queensland."*—

"*Eastwood Mine.*—The second seam is about a hundred feet below that exposed in the railway cutting, the outcrop showing in the gully. It has a thickness of seven feet, but there are several thin bands of shale. This seam is worked at a point about three hundred yards to the N.N.E. by Messrs. Archibald, as the Eastwood Mine, where the dip is 7 degrees to S.E. The coal is bright and bituminous, but very soft, and breaks small in carriage. It cokes well. Its specific gravity is 1·4.

Volatile in coking	25
Fixed carbon	63
Ash	12
	100"

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* Geology and Palæontology of Queensland and New Guinea," Jack and Etheridge. Brisbane: By Authority, 1890.

Fig. 2 gives a section of the Bishop Seam as found in the Donnybrook Mine. The seam in this and the neighbouring mines is most suitable for gas purposes and also makes a good coke, but it is less suitable for steam purposes on account of its friable nature.

The Boxwood Seam.—A considerable quantity of coal is reported to have been extracted from the tunnels on Portion 124. The seam worked here has always been regarded as the Bishop Seam, faulted down to this position by a fault running east and west along the boundary of Portions 127 and 124. The exposures of the strata in the bed of Sandy Creek, and the position of the outcrop of the Big Seam on the north bank of Sandy Creek to the east of the bridge, seem to indicate that the seam or seams worked in the Boxwood Tunnel are lower than that worked at the Donnybrook Mine, and in default of any direct evidence that they are the same I have mapped the former as underlying the latter.

5. *The Tivoli Seam and the Tivoli Fault.*—About 120 feet above the Bishop Seam is found the Tivoli Seam, the intervening strata being mostly shaley sandstone. It was first worked from a tunnel on the outcrop near the Old Tivoli Shaft, Portion 68, and a large quantity of coal was sent away from Portions 67, 68, 72, and 73. These workings are now deserted. The outcrop is seen on the road between Portions 68 and 73, and is exposed in the latter portion where the workings, which extended almost to the outcrop, have fallen in.

The workings to the north-east of the old Tivoli Mine are separated by the Tivoli Fault from those leading south from Wright's Tivoli Shaft in Portion 65 on the same seam. The shaft at Wright's Tivoli Mine was sunk near the outcrop of the seam, so that all the coal had to be worked to the dip. The shaft has now been abandoned for a tunnel leading straight from the outcrop.

The seam here dips at 12 degrees to south 65 degrees east, and is overlaid by sandstone. It has always been valued as a superior steam coal.

Fig. 3 gives a section of the seam in Wright's Tivoli Mine.

The Tivoli Seam is also worked from the Waterstown Shaft at a depth of 579 feet. Here the dip is south 30 degrees east at 14 degrees. Fig. 4 gives a section of the coal as seen in this mine.

Fig. 3

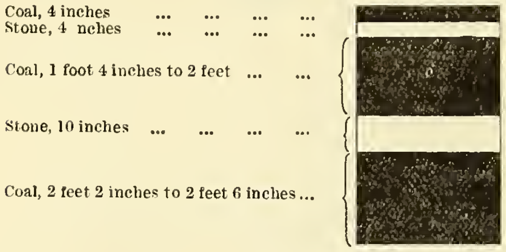
Coal, 4 inches ... ...
Stone, 4 inches ... ...
Coal, 1 foot 4 inches to 2 feet ... ...
Stone, 10 inches ... ...
Coal, 2 feet 2 inches to 2 feet 6 inches ...

Fig 4

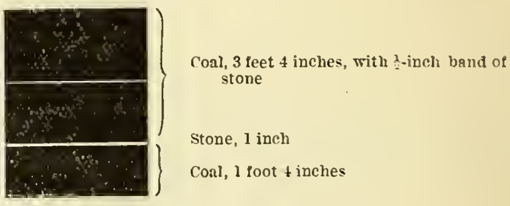

Fig. 3.—Section of Tivoli Seam, Wright's Tivoli Mine.
Fig. 4.—Section of Tivoli Seam in Waterstown Shaft.

On the north bank of Sandy Creek, on Portion 135, the seam has been opened up by a tunnel known as Davis's. The flooding of the creek prevented further work from being carried on here. Mr. Wright has since opened it up on the higher ground further north where the coal dips at 15 degrees to south 15 east. Here the seam is inferior, in quality and thickness. Fig. 5 gives a section of the seam as worked in this tunnel.

Fig. 5.

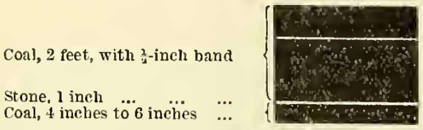
Coal, 2 feet, with ½-inch band
Stone, 1 inch ... ...
Coal, 4 inches to 6 inches ...

Fig. 6.

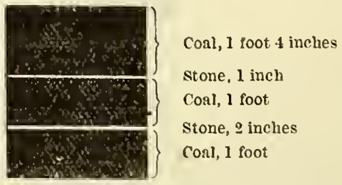

Fig. 5.—Section of Tivoli Seam, Wright's New Tunnel.
Fig. 6.—Section of Waterstown or Cuffe's Lower Seam, in the Waterstown Mine.

The outcrop of the seam can be more or less distinctly traced by the outcrop of the overlying sandstone from here to College's Crossing Road, through Portions 140, 139, 175, and 174.

West of Tivoli Creek, old tunnels are seen in Portions 111 and 108 on a seam on approximately the same horizon as the Tivoli, and which may be the same seam. The overlying white gritty sandstones with underlying shales can be traced to the railway cutting on the old Toowoomba Line.

6. *The Waterstown, or Cuffe's Lower Seam.*—The Waterstown Seam is met with at about 320 feet in depth in the Waterstown Shaft in Portion 78, thus lying 250 feet above the Tivoli Seam, the intervening strata in the shaft being mostly sandstone. The perpendicular distance between the two is thus about 240 feet. On the outcrop between the two seams shale appears to be more abundant than in the shaft. This seam is at present worked only in the Waterstown Mine. Its outcrop is exposed at the heads of the gullies on Portion 72, and can be traced to the boundary between Portion 67 and 66, where it is interrupted by the Tivoli Fault. North of this the seam was worked by Mr. Wright from a tunnel on Portion 65. It was also worked on the adjoining portion to the north, and by a tunnel driven in a south-west direction through the Bishop Fault. Fig. 6 is a section of the seam as worked in the Waterstown Mine.

7. *The Fiery Seam or Cuffe's Upper Seam.*—This seam lies about 50 feet above the Waterstown Seam in the Waterstown Shaft. It is not at present worked there, though it is reported to have furnished a good gas and house coal. It gets its name from its property of burning with a bright flame. Its outcrop is exposed above the Waterstown Seam on Portion 72, and, as noted before, it can be seen in the first cutting of the Tivoli Railway Line, on Portion 103.

Above the Fiery Seam is a considerable thickness of coarse sandstone and fine conglomerate, well seen on the road between Portions 72 and 78. East of Sandy Creek it can be again seen crossing the road into Portion 36. Here the seam underlying it was called the Bell Seam, though I have no doubt it is on the same horizon as the Fiery Seam. This seam is thus referred to by the Rev. J. E. Tenison Woods as quoted by Mr. Jack[*] in the Geology of Queensland :—

"The Bell Seam, which is about a mile from the Garden Seam, and belonging to the same proprietor (Mr. Moffatt), is about 3½ feet thick. It seems a more compact coal than the last (the Garden Seam lying above) and is a first-class coal for steam, gas, and coking. It is worked by a drive like the Garden Seam, about 200 yards long, and dipping 16 degrees, which is the dip of the seam, the direction being S. 15 degrees E. There is supposed to be a fault between this seam and the Garden Seam. A seam which crops out near the latter, and which has thinned out, may be the same. Its true position is supposed to be 150 feet below the Garden Seam."

I have estimated the position of the Garden Seam to be about 350 feet *above* the Fiery Seam, which I take to be identical with the Bell Seam.

Another quotation from the same page reads thus :—

"*Rossend.*—The Rossend Mine (Lindsay's) adjoins this property. It is worked by one shaft, to the extent of about 20 tons daily, on what is supposed to be the Bell Seam."

This shaft, now known as the Haighmoor, is on portion 1, and is worked by Messrs. Stafford Bros. It is sunk in the sandstone overlying the Fiery Seam, and reaches that seam at 130 feet. The dip is here S. 10 degrees E. at 15 degrees. The coal, in which there are three bands of stone, is about 4 feet thick.

8. *The Tantivy Seam.*—This seam has been lately opened up by a tunnel from the outcrop to the east of Tivoli Creek on the portion lying to the N.E. of Portion 168, parish of Chuwar, and is being worked by Mr. Bennett and his sons. It was also formerly worked from a tunnel on portion 78 further east, and is found at a depth of about 40 feet in the Waterstown Shaft. This places it about 230 feet above the Fiery Seam (Cuffe's Upper). The coal is rather dirty, but is disposed of locally for household and smithy purposes.

9. *The Garden Seam.*—The Garden Seam must be from 100 to 150 feet above the Tantivy Seam. Its outcrop can be defined from Tivoli Creek on the west over the summit of Tivoli Hill to the claypit of the Waterstown Brickworks on the east, where the original tunnels and workings are being disclosed by the excavations made for a brick clay, which is found overlying the seam. It appears to have been worked by various tunnels all along the outcrop from this point west as far as Gulland's Tivoli Tunnel, on Portion 169, but to what distance from the outcrop I was unable to find out. The seam has not been exploited east of the Waterstown Brickworks nor west of Tivoli Creek, but the probable line of its outcrop in these directions is shown on the map.

The seam is reported to have furnished an excellent steam coal all along its outcrop between these two points, and was thus referred to by the late Rev. J. E. Tenison Woods, as quoted by Mr. Jack in his Geology of Queensland,[†] page 349 :—

"*Waterstown Mine.*—This is a colliery which is being worked by two or three shafts, all on the north side of the Bremer and very close to its banks, and where it is navigable for small craft. There is a shaft upon the Garden Seam, which is about 7 feet thick and crops out on the surface. It has a dip of usually 1 in 5, S15 degrees 20 minutes E. The coal has a short fracture, breaks into small cubes, soils the fingers, and is full of bright bituminous streaks."

Of the coal from this mine Mr. A. C. Gregory reports :—"The coal is a fairly hard coal, cokes well, and is a good steam coal. The following is the analysis :—

Fixed carbon	62·0
Volatile hydrocarbons	25·2
Ash	12·8
	100.0"

Bremer Basin Company's Seam.—A shaft sunk by the Bremer Basin Company south of the river from Gulland's Tivoli Mine, on Portion 71, met a seam of coal at—as I understand from Mr. R. D. Graham—150 feet in depth ; Mr. James Archibald gives the depth as 300 feet. This was, no doubt, the Garden Seam, but appears to have been of inferior quality, possibly owing to percolation of water along the seam from Tivoli Creek, which cuts across the outcrop further west.

10. *Future Extension of the Work of Winning the North Ipswich Coals.*—As mentioned before, the bulk of the coal won from the North Ipswich Seams has been obtained from between Mihi and Sandy Creek. East of Sandy Creek at least four of the seams have been exploited, but none of them to any great extent, and apparently the seams are not of such good quality in this direction. Thus the Tivoli Seam is distinctly inferior as found at Wright's new tunnel compared with its quality where it has been extensively worked further west, while the seams found in the Haighmoor Shaft cannot compete against the same coal as found in the Waterstown Shaft.

West of Tivoli Creek coal was formerly obtained from some of the lower seams, but no work has been done there for some time, though the coal is reported to have been good in this direction, and was worked with success across the river at Woodend Pocket. The average dip of the coals is between 1 in 4 and 1 in 3. The dotted line on the map cutting across the Basin Pocket shows roughly the position at which the Garden Seam may be expected to be at about 1,000 feet in depth if this dip continues, and as the other seams are all contained in the 1,000 feet of strata next below, they may all be expected to be found within a depth of 2,000 feet to the N.W. of this line. It is probable, however, that the dip decreases with the depth; since the beds are found rising again on the other side of the basalt between Bundanba and Dinmore, and naturally may be expected to lie more or less horizontally for some distance round Booval. The whole of the land along both sides of the river from Woodend Pocket down to Bundanba Creek, roughly comprising the areas enclosed in the bends of the river and covered by alluvium, may be reckoned upon as likely to afford coal at reasonable working depths when the coal nearer the surface on the north side of the river has become exhausted.

The strike of the beds to the west of Tivoli Creek swings around and runs in a north-westerly direction with steep dips of up to 70 degrees and 80 degrees to S. 60 degrees W. It is probable that the same coals may be found along the line of strike shown on Map 1, in the land lying north from the Coalfalls towards the Pine Mountain though their highly inclined condition may possibly be accompanied by considerable faulting and crushing.

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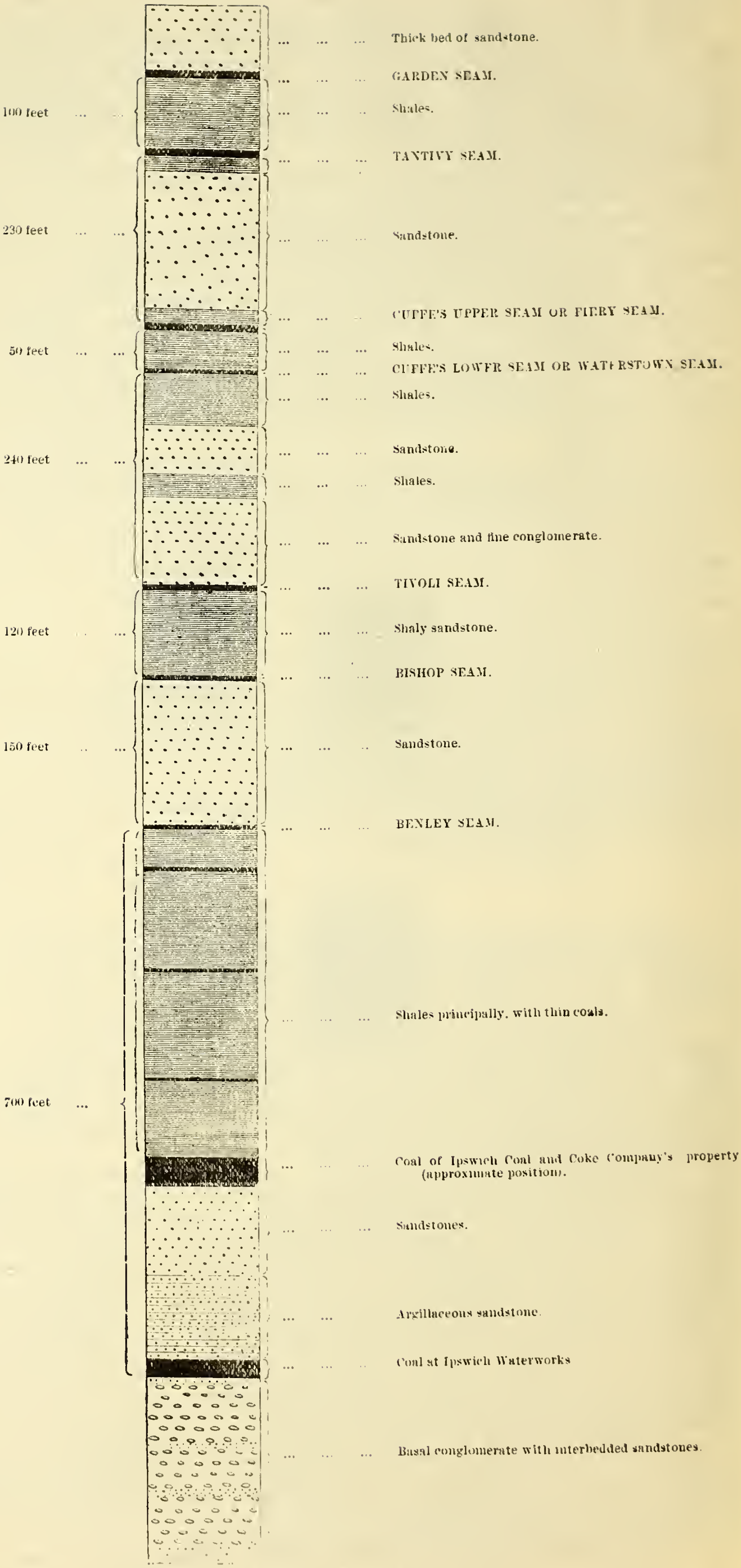
[*] 'Geology and Palæontology of Queensland and New Guinea," p 344.

[†] "Geology and Palæontology of Queensland and New Guinea," Jack and Etheridge. Brisbane : By Authority, 1892.

Fig. 7.


Thick bed of sandstone.
GARDEN SEAM.
100 feet
Shales.
TANTIVY SEAM.
230 feet
Sandstone.
CUFFE'S UPPER SEAM OR FIERY SEAM.
50 feet
Shales.
CUFFE'S LOWER SEAM OR WATERSTOWN SEAM.
Shales.
240 feet
Sandstone.
Shales.
Sandstone and fine conglomerate.
TIVOLI SEAM.
120 feet
Shaly sandstone.
BISHOP SEAM.
150 feet
Sandstone.
BENLEY SEAM.
Shales principally, with thin coals.
700 feet
Coal of Ipswich Coal and Coke Company's property (approximate position).
Sandstones.
Argillaceous sandstone.
Coal at Ipswich Waterworks
Basal conglomerate with interbedded sandstones.

Vertical Section North Ipswich Coal Beds from Basal Conglomerates to Garden Seam.

III.—THE COAL BEDS AT BLACKSTONE AND BUNDANBA.

1. *General Disposition of the Beds.*—The mines and prospecting work in this locality expose coal seams over an area of about fifteen square miles, lying to the south of the Brisbane and Ipswich Railway Line, between Bundanba and Dinmore Stations, extending from Bundanba Creek on the west to Six-mile Creek on the east, and for at least five miles to the south of the railway line.

The surface of the ground is uneven and hilly, and thickly timbered, except where the timber has been cleared to afford supports for the underground workings, and surface machinery of the mines, for which purposes it has proved very valuable.

The strata consist of the usual lenticularly-bedded conglomerates, sandstones, and shales, none of which afford sufficiently well-marked features to allow of their being traced on the surface for any considerable distance.

A plan of this portion of the coalfield has been prepared for the Government by Mr. R. D. Graham, licensed surveyor, and is at present waiting publication at the Geological Survey Office.*

Mr. Graham and myself have come to different conclusions on several points, and reference to his plan will be found throughout this report whenever such differences occur.

The beds dip away from the centre of this area on the Cooneana Estate to the east towards Six-mile Creek, to the west towards Bundanba Creek, and to the south towards the southern portion of the Cooneana Estate. In the latter direction the beds are bent up on a synclinal axis along the southern boundary of the estate, but regain the former dip further south (Map 1).

The north-eastern corner is intersected by a large fault striking about N.W. and hading to the N.E., which was met at about 20 yards from the mouth of a tunnel on Portion 256, by Mr. J. Stafford, of the Whitwood Colliery, and which can be traced by the upturned edges of the strata to the S.W. through Portions 255, 267, and 270.

Mr. Graham in his plans shows the downthrow of this fault to be to the S.W., but the position of the beds on its north-eastern side dipping steeply to the N.E. shows that the downthrow is in all probability in the latter direction.

To the N.E. of this fault the strata rise very gradually to the N.E., but are disturbed by numerous faults with throws of up to 100 feet.

The seams have been worked most extensively along the outcrop of the westerly dipping beds from Bundanba to some distance to the south of Blackstone, and also in the neighbourhood of Dinmore to the N.E. of Stafford's Tunnel Fault.

Owing to the scattered nature of the workings in this district a considerable amount of information can be gained as to the general lie of the coal beds, especially along the north and west. Numerous bores, however, have been made, holes sunk, and tunnels driven on seams, which, if a proper record had been kept, would have greatly added to our knowledge of the positions and value of the different seams. This is particularly the case along the eastern and southern fall of the beds where a considerable amount of prospecting work in the shape of tunnels and shafts on coal seams has been made. Most of these have fallen into decay and give little information as they stand as to the value of the seams in this direction.

2. *The Coal Beds at Blackstone.*—A fairly continuous section of the westerly dipping coal beds in the neighbourhood of Blackstone and Bundanba is obtained from records of bores and shafts in these localities. Fig. 9 is an approximate vertical section of the strata and seams as found in the Aberdare, West Moreton, Borehole, and Braeside Shafts. It shows five seams in the lower beds in a distance of from 250 to 350 feet, separated by alternating thin sandstones and shale. These seams were worked along their outcrops between Blackstone and Bundanba on the eastern bank of Bundanba Creek under which they dip to the west. The second highest of them is still worked at the Braeside Colliery at Bundanba. There seems to be some doubt as to whether the Braeside No. 1, and Stafford's Four-foot-six Seam are not really identical, in which case the number of these seams must be reduced by one. Above Stafford's Four-foot-six Seam, the highest of these lower seams, there is, as seen at Blackstone, a considerable thickness of sandstone, above which are shales and sandstone containing the Bluff or Dirty and Aberdare Seams. A bed of coarse conglomerate lies some 150 feet above the latter seam, and above it again there are thin sandstones and shales in which occurs the West Moreton Seam found in the West Moreton Colliery.

All these seams, with the exception of the uppermost, crop out either at Blackstone or immediately to the east of it, where they are marked by various tunnels on their outcrops on portions 174 and 173. To the south the outcrops of these seams can be more or less accurately inferred from the strike of the accompanying strata bending to the east of the prominent hill lying to the south of the village, till they are lost under the alluvium of the gully draining into Box Flat, Portions 294 and 295.

North of Blackstone the outcrops of the two upper seams are obscured under the alluvium of Bundanba Creek, but those of the lower seams are exposed by various tunnels along the right bank of Bundanba Creek as far as the Brisbane and Ipswich Railway Line at Bundanba.

(1.)—*The Aberdare Seam and Colliery.*—The most northerly exposed point of the Aberdare Seam is marked by a tunnel driven on it in the Borehole Company's Property (Portion 174, Parish of Goodna), and it runs thence south through the village along the eastern brow of the hill lying south of the village. Here the outcrop is marked by an air shaft on the N.E. corner of Portion 270. The hill is capped by a thick bed of coarse conglomerate and grit, lying about 150 feet above the seam, which can be followed to the south till it is obscured under the alluvium of Box Flat.

West of this line of outcrop the seam is again exposed by a gully cutting down through the conglomerate on the western side of the hill and draining into Bundanba Creek. This outcrop when mapped shows as a closed oval-shaped line. It was from tunnels driven on the seam from the outcrop in this gully that the seam was first worked, and the coal has been practically worked out from under the hill up to the eastern outcrop. At Blackstone the seam dips west at about 15 degrees, further south the dip swings around towards the south till on Portion 286A, it is almost due south.

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* No. 142 of the Geological Survey publications.

As the coal became worked out from under the hill it had to be obtained from further to the dip, and the two shafts, Nos. 1 and 2, were sunk for that purpose. The former reaches the seam at 235 feet, and the latter at 450 feet. No. 1 Shaft is at present used only as an upcast for the workings round the No. 3, or Coolgardie Shaft, which was sunk later on, almost on the direct dip of the coal from No. 1, and which meets the coal at a depth of 523 feet. The greater portion of the coal at present turned out from the colliery comes through this shaft, and the level extends into Portion 154, north of the Blackstone Road, where the dip is to the S.W.

A considerable quantity of coal has been taken from Portions 300 and 286 from the No. 2 Shaft. Here the dip of the coal is from S.W. to S. at about 20 degrees. The sinking of a new shaft had been commenced on portion 183 for the purpose of striking the coal to the dip of the levels running east from the No. 2 Shaft, which were abandoned owing to fire, but this work has since been stopped.

The Aberdare Seam in the Coolgardie Shaft is broken through by what was no doubt an igneous dyke, as the coal is coked for eight or ten inches on either side, though it is now altered to a soft white clayey material. The dyke running in a direction a little east of north cuts obliquely across the levels, south from the shaft; it has perpendicular walls, and is about four feet in width. The dyke has been traced south into the workings of the West Moreton Colliery, and its position taken from the plans of these two collieries is shown on the map.

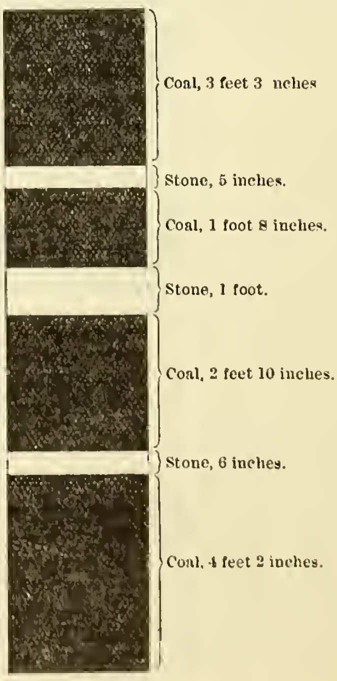
Another intrusion is found in the southern levels and in the dip workings from this shaft. This is of a soft black clayey material with small pieces of coal included by it, the black colouring being due to carbonaceous material. It lies at a slightly steeper angle than the coal, and can be observed in the workings cutting very obliquely across it in a flat sheet of about 4 feet in thickness. The edges of the coal are ruffled up in places by the intrusion, but the coal is not coked or altered in any way.

(2.) *The Aberdare Seam at the West Moreton Colliery and the West Moreton Seam.*—The West Moreton Shaft on Portion 180 reaches the Aberdare Seam still further to the dip than the Aberdare No. 1 Shaft, at 630 feet from the surface. The seam dips at about 22 degrees to the S.W. The seam was worked over a considerable area, but all the workings to the dip met with a fault, the position of which, taken from a plan in the Mines Department, is shown on the map. Mr. Rands inspected this fault in 1894, and concluded that its upthrow was to the S.W.* The Aberdare Seam has not been found S.W. of the fault, where it should occur at shallower depths than in the old workings if the upthrow of the fault is to the S.W. A shaft was begun for the purpose of striking it on Portion 228, but, unfortunately, it was put down in one of the altered igneous dykes which occur associated with the basalt between Ipswich and Bundanba Creek, and was abandoned after a depth of 80 feet had been reached.

The Aberdare Seam has been abandoned in this mine, being practically worked out on the N.E. side of the fault, and is at present inaccessible owing to the accumulation of water in the mine. What is known as the West Moreton Seam is worked at a depth of 160 feet in the shaft, and gives about 2 feet 3 inches of coal. Journals C and D, pages 28 and 29, give a section of the strata met with in the shaft. Fig. 1, Plate I, is a section on the line C. D. on the maps showing the lie of the coals in the West Moreton Shaft.

(3.) *Character of the Aberdare Seam.*—Fig. 8 gives a section of the seam taken in the workings near the No. 3 Shaft of the Aberdare Colliery. The seam is worked in two sections, the point of division of the two being the 1-foot band of stone about the middle. At present the lower section is mostly worked giving 7 feet of clean coal with a 6-inch band of stone at 4 feet 2 inches from the floor. The upper section, however, was also extensively worked near the outcrop, where it furnished a greater thickness of coal than that shown in the figure. It has recently been opened up again in the levels to the north of the No. 3 shaft of the Aberdare Colliery, where it furnishes a good coal.

FIG. 8.



SECTION OF ABERDARE SEAM AS WORKED NEAR THE COOLGARDIE SHAFT IN THE ABERDARE COLLIERY.

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* Annual Progress Report of the Geological Survey for the year 1894, page 26.

The Aberdare Seam undoubtedly furnishes the best steam coal found in the district. It is rather brittle, breaking into cubes, is dull in lustre, and soils the fingers when handled. An analysis of a sample sent to the International Exhibition, Bowen Park, Brisbane, 1897, where the coal received first prize of those sent from the Ipswich Field, being second only to that from the Howard Mine, Burrum Coal Field, is given in the table of analyses on page 21.

(4.) *Extension of the Work on the Aberdare Seam to the West and North.*—This, the most valuable and hitherto the most extensively worked of the seams found near Ipswich, has been proved almost continuously, and shown itself very constant in character, over an area of somewhere about two-thirds of a square mile. It is a seam of the utmost importance to the district on account of its superior qualities as a steam coal, and its thickness and constant character. Its average dip to the west in the Aberdare Colliery is about 15 degrees, and its depth at any given point can be fairly accurately judged from its depth in the No. 1 and No. 3 Shafts, the heads of which are on very nearly the same level. A continuance of the same dip would bring the seam to about 1,000 feet below the level of these shafts in the middle of Portion 157. At Ipswich, sandstones and shales are found dipping to the east under the basalt, which extends to Bundanba Creek. The section at the foot of Map 2 shows the lie of the beds under the basalt as far as can be judged from the information available. From this it may be inferred that the dip of the Aberdare Seam will flatten as it is followed to greater depths, and it is probable that it is nowhere more than 2,000 feet below the level of the No. 1 and No. 3 Shafts between the Aberdare Colliery and Ipswich. To the north the workings from the No. 3 Shaft have crossed the Blackstone Road, and the dip here swings round a little to the south of east. How far the seam preserves its superior qualities in this direction is a matter of speculation, but there is no reason to suppose that it will deteriorate. The outcrop of the seam to the east of this area is hidden under the alluvium, and its probable position is shown on the map. This alluvium is no doubt almost continuously saturated with water which may be expected to find its way for some distance along the seam, so that in working towards the surface here it will probably be found necessary to leave a considerable barrier of coal along the outcrop. An accurate contour survey of the surface would thus prove of great benefit here as affording a means of estimating how far to the rise the coal could be worked so as to avoid trouble from this drainage. The seam may be reckoned on as likely to afford coal at reasonable working depths under all of the Portions from 144 to 161, with the exception of 149 and 150. As we pass north and west from this area the prospects of the profitable working of the seam become more uncertain—but there is every probability that the seam will one day be worked over a large area around Booval and Newtown.

(5.) *The Bluff, or Dirty Seam.*—The Borehole Shaft (Portion 174, Parish of Goodna) reached the Bluff, or Dirty Seam at 120 feet below the Aberdare (*see* Journal B, page 28), while the distance between the two, as found in the West Moreton Shaft (Journal C, page 28), is about 200 feet. The angle of dip at the former place being about 15 degrees gives 116 feet as the vertical distance between the two seams, and the angle of dip at the latter being about 22 degrees gives 185 feet as the vertical distance between them at this point. The journals show that in both places the intervening strata are shales and shaley sandstones. This character is also noticed at their outcrop to the south of Blackstone Village.

The Bluff Seam was opened up by a drive on the Borehole Company's Property on Portion 165, and Mr. James Archibald, late manager for the company, informed me that it showed about 30 feet of alternate stone and coal bands. Journal C, page 28, shows that it was of much the same character in the West Moreton Shaft. The seam has not yet afforded workable coal near Blackstone.

(6.) *Stafford's Four-foot-six Seam.*—The Borehole Shaft (Journal B, page 28), shows about 296 feet of strata between the Bluff Seam and that next below—viz., Stafford's Four-foot-six Seam. The lower half of these strata, as seen on the outcrop, is sandstone, which passes further south into coarse grit, and is found cropping out on the N.E. corner of portion 286A. The seam was worked to some extent on the Borehole Property, and, according to Mr. James Archibald, gave 4 feet 6 inches of clean coal. The seam was also more extensively worked in the Rose Hill Colliery, to the north, on Portions 163 and 164, by Messrs. Stafford Bros., and also on Portion 162, but not further north than this.

(7.) *Seams below Stafford's Four-foot-six Seam.*—According to Mr. James Archibald, three seams below Stafford's Four-foot-six Seam were opened up on Portion 165; but they were not worked to any great distance from their outcrop. Two seams, probably the two upper ones of these, were worked on Portions 162 and 163. North of Portion 162 the continuity of the seams is reported to be broken by a large fault which was met with in the tunnel workings. I could get no definite information as to the direction of this fault—but have drawn it in parallel with the other main faults of the district. The downthrow is said to be to the north. Mr. Graham draws the fault in a line almost at right angles to that shown on Map 1.

On Portion 161, three seams were worked, called respectively, "Bergin's Seam," the "Strip of Bacon," and the "Rob Roy" Seam in descending order. There is nothing to show whether Bergin's Seam is identical with Stafford's Seam, or with the one lower, but it is generally supposed to be the latter, and is so shown on Mr. Graham's Plans.

In this case a seam found on Portion 242, still lower than the above three, is one lower than any of those found on the Borehole Property. It was known as Doby's Seam. On Mr. Graham's Plan two still lower seams are shown, the first a four-foot seam cropping out along the road east of the above portions, and the second a ten-foot seam cropping out on Portion 241 east of the road. These seams have not been opened up, and I could get no information about them. It is doubtful whether they are of any value, as they would no doubt have been worked before this.

3. *The Coal Seams at Bundanba*—(1.) *The Braeside Colliery.*—Four seams dipping at about 14 degrees to the west are met with in the two shafts of this colliery on Portion 159. The No. 1 Shaft to the east, and near the boundary of Portion 222, met these seams at 15 feet, 90 feet, 130 feet, and 270 feet respectively from the surface, and they are known as the Braeside No. 1, No. 2, No. 3, and No. 4 (or Hard Coal). The No. 2 Shaft, about twelve chains to the dip, met the uppermost of these seams at a depth of about 100 feet. The plans of the workings from these shafts, kindly lent me by the proprietor, Mr. Lindsay, show that the three uppermost seams were worked over a considerable area; and Mr. Lindsay informs me that they all furnished good coal between three and four feet in thickness. The No. 1

Seam is generally supposed to be identical with the uppermost seam worked on Portion 161, and known as Bergin's Seam, in which case the lower ones are no doubt the Strip of Bacon, the Rob Roy, and Doby's Seam in descending order.

None of these seams are at present worked from the shafts, all the coal sent out from the colliery being extracted from the No. 1 Seam by an inclined drive from above the outcrop on Portion 222. The seams were inaccessible during my visit. Analyses of the No. 1 and No. 4 seams are given in the table of analyses, page 21.

(2.) *Continuation of the Seams North and East of the Braeside Colliery.*—North of the Braeside Colliery, the strike of the beds swings round to N.E and E. over an axis striking N.W. between it and the old Day Dawn Colliery, on Portion 246. Here the dip is a few degrees to the E. of N. at about 15 degrees. Judging from the outcrop of sandstone underlying the No. 3 Seam of the Braeside Colliery, which can be traced across the gully between the Braeside and Day Dawn Mines, the seam worked in the latter mine is identical with the No. 2 Seam of the former. A tunnel has been driven into Braeside No. 3 Seam, on the northern boundary of Portion 244. Mr. Graham has marked a fault of some magnitude between these two mines. I was unable to see any evidence of such on the surface, nor did I hear of its being met with in any of the mine workings. The change of dip on passing from the former to the latter mine is easily accounted for by the bending over of the strata, and although some slight faulting may occur, there appears to me to be no evidence of one of any magnitude. The same seam has also been worked further to the east on Portion 256 by Messrs. Stafford Bros. East of this the outcrops cannot be traced.

These two collieries are thus referred to by Mr. Fryar, as quoted by Mr. Jack in his Geology of Queensland on page 342:—*

"*Scarborough's Seam* is four feet in thickness, with three small variable bands, irregular in thickness and position. It is worked at the Day Dawn Mine, Parish of Goodna.

"*Stafford's Seam* (which, however, is not the same worked by Messrs. Stafford), adjoins Scarborough's Seam. Its thickness varies from two feet six inches to four feet. It has many small dislocations and usually two thin bands."

What appears to be Lindsay's No. 1 Seam was worked by two tunnels on Portions 149 and 141, immediately north of the railway, and known as the Speedwell and Wallsend respectively, but I could obtain no information as to the extent of the working.

4. *Value of the Lower Coals between Blackstone and Bundanba and their probable depth below the Surface further West.*—I was unable personally to inspect any of the lower coals as the tunnels from which they were formerly worked, except at the Braeside Colliery, have fallen into decay. At the time of my visit the seams were inaccessible in the Braeside Colliery owing to trouble with water in the mine from old workings. Judging, however, from the amount of coal already extracted, as shown by the numerous tunnels along the outcrop and from information gathered from those engaged at them, it would seem that the coals could be profitably worked at shallow depths, but that as soon as greater depths made the working more costly the tunnels were abandoned for places where coal could be obtained at less expense.

As estimated from the bore and shaft journals the depth of Stafford's Four-foot-six Seam along the Aberdare Branch Line must be about 600 feet at least to as far north as where the line takes a slight bend to the west, so that over all the alluvial area to the east of this line the seam in all probability lies at a less depth than 600 feet. The lower coals would lie at correspondingly lower depths.

Taking the dip of the Braeside No. 1 Seam as 14 degrees west its depth along the western boundary of portion 158 should be about 620 feet below its level in the No. 2 Shaft of the Braeside Colliery, where it is found at about 100 feet, *i.e.*, 720 feet. Stafford's Four-foot-six Seam, which is supposed to lie about 100 feet above it, would thus be about 620 feet in depth. As the surface between these points shows little rise and fall, 620 feet may be taken as the approximate depth of the Four-foot-six Seam below the surface along a line in continuation direct south of the eastern boundaries of Portions 157 and 158.

As shown by the depths of these lower seams in the Braeside No. 1 Shaft we have here at least four seams within a vertical distance of 255 feet, or an average of about 64 feet between each other. As shown before it is doubtful whether Stafford's Four-foot-six Seam is identical with the Braeside No. 1 or not, but supposing it to lie 100 feet above, which is apparently a liberal estimate as far as can be judged from the information obtainable, these four or five seams should all lie between from about 600 to 1,000 feet below the surface along the western edge of the alluvial flat, and at correspondingly shallower depths towards the east. It is very probable from the general geological structure of the neighbourhood that the dip flattens towards the west, at least in the more northern part of the area under consideration, and an exposure of the sedimentary beds under the basalt, seen on the railway line immediately east of Bundanba Station, seems to support this view, as the beds here, although disturbed where the basalt has flowed over them and rumpled them up into short folds, still seem to lie more nearly to the horizontal than they do further south.

There is no reason to doubt that as the development of the coalfield extends and the demand for coal increases these lower coals will be called into requisition as the more easily accessible outcrop coal is worked out.

5. *Thickness of the Coal Measures at Blackstone and Bundanba.*—Journal C, page 28, shows a distance of 630 feet from the topmost bed of sandstone met in the West Moreton Shaft to the Aberdare Seam, which, allowing for a dip of 22 degrees, gives a thickness of strata of about 580 feet. Journal B, page 28, shows 416 feet between the Aberdare Seam and the Four-foot-six Seam, which, allowing for a dip of 15 degrees, gives a thickness of strata of about 400 feet. This gives a thickness of strata of about 980 feet from the uppermost bed of sandstone proved in the West Moreton Shaft to Stafford's Four-foot-six Seam.

Mr. Graham, in his plan and section, gives Stafford's Four-foot-six Seam as occurring near the surface in the Braeside No. 2 Shaft (called No. 1 on Mr. Graham's Plan), but Mr. Lindsay, the owner of the colliery, informs me that no seam was met with near the surface in that shaft. Assuming that the Braeside No. 1 Seam is the same as Bergin's, and that the latter is the next below Stafford's Four-foot-six Seam, there is a distance of 90 feet between the two, which, added to the 255 feet between the No. 1 and No. 4 Braeside Seams in the No. 1 Shaft, gives a distance of 345 feet from Stafford's Four-foot-six Seam to the Braeside No. 4 Seam, or a perpendicular distance between the two of about 320 feet. This gives a thickness of proved strata at Blackstone of 1,300 feet.

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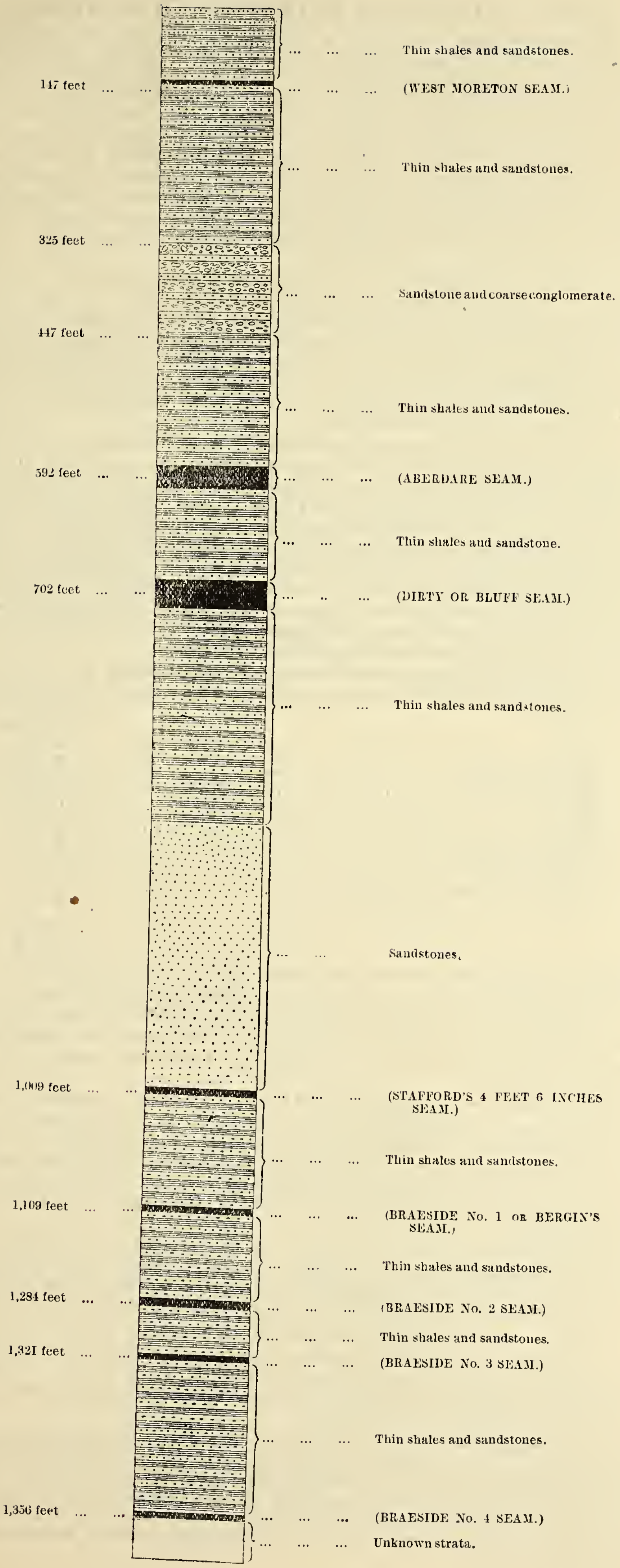
* "Geology and Palæontology of Queensland and New Guinea," Jack and Etheridge. Brisbane: By Authority, 1892.

Fig. 9.


... ... Thin shales and sandstones.
147 feet ... ... (WEST MORETON SEAM.)
... ... Thin shales and sandstones.
325 feet ... ...
... ... Sandstone and coarse conglomerate.
447 feet ... ...
... ... Thin shales and sandstones.
592 feet ... ... (ABERDARE SEAM.)
... ... Thin shales and sandstone.
702 feet ... ... (DIRTY OR BLUFF SEAM.)
... ... Thin shales and sandstones.
... ... Sandstones.
1,009 feet ... ... (STAFFORD'S 4 FEET 6 INCHES SEAM.)
... ... Thin shales and sandstones.
1,109 feet ... ... (BRAESIDE No. 1 OR BERGIN'S SEAM.)
... ... Thin shales and sandstones.
1,284 feet ... ... (BRAESIDE No. 2 SEAM.)
... ... Thin shales and sandstones.
1,321 feet ... ... (BRAESIDE No. 3 SEAM.)
... ... Thin shales and sandstones.
1,356 feet ... ... (BRAESIDE No. 4 SEAM.)
... ... Unknown strata.

Vertical Section of Strata and Coal Seams Found at Blackstone from Surface at West Moreton Shaft to Bottom of Braeside No. 1 Shaft.

IV.—THE COAL BEDS AT SWANBANK AND COONEANA.

1. *Continuation of the Seams to the South of Blackstone.*—The grit and conglomerate overlying the Aberdare Seam and forming the summit of the hill on Portion 270, south of Blackstone, on being followed to the south-east is lost under the alluvium of Box Flat. On the north-east of the flat there is, at the south end of Portions 294 and 295, a hill of coarse grit, underlain by shales. A shaft has been sunk into coaly shale beneath the grit, and the dip, as shown by the shales exposed in the shaft, has swung round to S. 50 degrees W. at about 15 degrees. The dip in the Aberdare Colliery workings on the southern boundary of Portion 270 is to the S.W. This grit is therefore probably the continuation of the bed of coarse sediments overlying the Aberdare Seam at Blackstone, and its position so far east is accounted for by the change of dip round from west towards the south-west. The thick bed of sandstone overlying Stafford's Four-foot-six Seam at Blackstone is again seen cropping out on the north-east corner of Portion 286A, with a dip to the S.W., and sandstone is again found below the grit and shales on Portion 295.

On following the outcrops further to the south-east, what is apparently the upper bed of grit can be picked up again, forming the capping of the hill on Portion 297. The hill presents a marked escarpment to the N.E., and slopes away along the dip of the beds to the S.W., and a tunnel on the north-eastern side exposes a thick seam of coal immediately underlying the grit, and dipping at about 10 degrees to S. 20 degrees W. A second tunnel, a few yards to the N.E., exposes a lower seam, and prospecting holes show shales between the two. A little further to the east the outcrop of a second and lower bed of grit is seen, and can be traced as a continuous escarpment, running first east and then north-east to the eastern side of Portion 286B.

The two seams of coal found under the upper bed of grit are apparently on the same horizon as the Aberdare and Bluff Seams—*i.e.*, in the shales lying between the upper and lower beds of coarse sediments. Whether they can be regarded as the same seams is more problematical, for it is quite possible that in such a distance the original seams may have thinned out or passed into shales and new seams have come in. In any case the shales and sandstones between the two coarser beds, which are at least 250 feet thick at Blackstone, are considerably thinned here, and if we regard the upper seam as the Aberdare Seam, the 140 feet of shales found between that seam and the conglomerate bed in the Aberdare No. 3 Shaft is here almost entirely absent, the coal immediately underlying the coarser beds.

Following the outcrop of the upper bed of grit—which is here of considerable thickness—to the south it is lost in the bed of the watercourse, which, running west, cuts through it near the road between Portions 297 and 18. The dip has here come round to the west again.

Mr. Woolley, manager of the Swanbank Colliery, has stripped down the face of coal exposed in the tunnel on the upper seam on the S.W. corner of Portion 286B since my visit, and has kindly forwarded me the following section :—

	Feet.	Inches.
Coal	2	0
Batt and Stone	0	5
Coal	0	4½
Batt	0	1
Coal	0	2
Batt and Stone	0	3
Coal	0	8
Black Smut, inclined to be Coal	0	1
Coal	3	0
	7	0½

He considered that the lower 3 feet 9 inches would afford a good workable seam.

2. *The Swanbank Seams.*—On Portion 13 and the southern part of Portions 17 and 18 is a hill capped by coarse conglomerate and grit which presents a steep face to the east and slopes gradually towards the west. Under the coarse beds are fine ones of sandstone and shale, containing several seams of coal which crop out on the south-eastern side of the hill, and dip under the hill in a general westerly direction.

The Swanbank Colliery.—The shaft of the Swanbank Colliery is situated to the S.E. of this hill on Oaky Creek, and reaches the uppermost seam underlying the conglomerate at a depth of 100 feet. The seam was first worked by a tunnel from the outcrop on the eastern face of the hill due east from the shaft and on the boundary of Portion 13. A second seam is found cropping out on the eastern face of the hill below the former, and is marked by a tunnel further north. This seam is at present worked at a depth of 167 feet in the Swanbank Shaft, the upper seam having been abandoned owing to its inferior quality.

The main dip, which is about S. 60 degrees W., has been extended about eighty yards from the shaft and levels have been driven off to left and right. The levels going to the north met with a fault on the boundary of portions 13 and 17, striking about W. 20 degrees N., the position of which, taken from the plans of the mine kindly lent me by Mr. Woolley, the manager, is shown on the map.*

Perkins' Freehold.—On the N.W. boundary of Portion 12, a seam has been opened out which is supposed to be a still lower one than the Swanbank No. 2, and a trolly line takes the coal to the terminus of the Swanbank Railway Line on the northern bank of Oaky Creek. A shaft had also been commenced near the bank of this creek, but had not reached the seam at the time of my visit. The seam shows about 5 feet of coal with some bands of stone.

3. *Probable Extension of the Aberdare Seam under Box Flat towards the Swanbank Colliery.*—At the summit of the hill north of the Swanbank Colliery, and some distance to the north of the fault found in the workings, coarse sandstone and grit is found dipping at 25 degrees to N. 30 degrees W. The beds are apparently much disturbed, and it is impossible to say whether this bed of grit is the same as

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* Since writing the above I have been informed that the fault has been driven through, and good coal found to the north. The throw of the fault is only a few feet.

that found further north on Portion 297, brought into this position by the tilting up of the bed. If it is, the Swanbank Seams are very probably on the same horizon as the Aberdare and Bluff Seams. They do not resemble them in thickness nor in their sections, but judging by the variations of the other seams in the district when followed from point to point, it can hardly be expected that the seams in this neighbourhood would remain constant in character over such a wide area. This occurrence under a similar bed of conglomerate with dips that accord well with the supposition leads one to suspect that they are on the same horizon, and they may provisionally be supposed to be so till the contrary is shown.

The furthest point to the east to which the Aberdare Seam has been worked from the No. 2 Shaft was in the levels along the southern boundary of Portion 286A, which terminated at a fault shown on Map 1. The south-eastern extension of the West Moreton Fault is shown by the broken red line. The reversed dips seen on the road south of Portion 220 seem to indicate that the influence of the fault extends at least as far as this. The tilting of the beds north of the Swanbank Colliery, and the position of the fault in the northern working, which Mr. Woolley has penetrated since my visit, and which he says has a downthrow to the north, seem to indicate that the West Moreton Fault is continued here with a more easterly bearing.

If the inference drawn above from the observations made are correct it would appear that the Aberdare Seam should underlie the whole of the area occupied by Box Flat, and the enclosing higher ground up to the inferred outcrop of the seam. An estimation of its depth at any point must necessarily be only a rough one, but a very good idea could be formed by the sinking of a few bores over the area and a rough contouring of the country. It is probable, however, that the seam will be found at a depth of less than 1,000 feet at the bridge over Bundanba Creek near Portion 185. The whole of this area would thus seem to be well worth prospecting for this valuable seam of coal.

4. *Coal Seams to the South and East of Swanbank.*—A traverse of the road leading east from the top of Swanbank Hill passes over the shales in which are the Swanbank Seams underlying the conglomerate till a tunnel on coal is met with near the northern boundary of Portion 131, Parish of Goodna. The coal dips gently to the north, and apparently underlies only a small area of the higher ground. We are here passing over a north and south anticlinal axis, as the beds further east dip away to the east. The seam of coal exposed is no doubt one of those worked at Swanbank, brought in again by the bending over of the strata. Further east the same shales are passed over till grit and fine conglomerate is again met with on the road between Portions 127 and 135. The extension of this capping of coarser rocks is roughly outlined on the map. A tunnel has been driven into a seam of coal immediately underlying it at the north of Portion 127. The seam appears to be of good quality and thickness, and dips gently to the east. The conglomerate is apparently the same bed that is found to the west at Swanbank, brought in again by the folding over of the beds across the north and south anticlinal axis mentioned above.

5. *The Coal Seams on the Cooneana Estate and Adjoining Properties.*—The outcrop of the lower grit-bed, underlying the two seams exposed on the western boundary of Portion 286B, runs as a continuous escarpment east and north-east across the portion to where another seam is exposed below it, in the two tunnels dipping east 20 degrees south at about 10 degrees, as shown on the map. Further than this the outcrop cannot be distinctly traced, but it probably crosses the Redbank Plains Road east of the bridge over Ferny Creek. Here the dip is east. Coarse grit is again found on Portion 281 and 282, and is apparently the same bed brought down by a fault running through Portion 281. The effects of the fault are seen on the surface of Portion 281 in the tilting of the strata and sudden change of dip.

On Portion 280 a shaft sunk under the grit exposes a seam of coal which I am informed showed 30 feet of coal and bands. Coal is seen cropping out under the grit near the top of the hill in the southern portion of 252, and in the gullies on the east of 257. Tunnels have been driven into coal at the top of the hill north of Portion 252, and a shaft has been sunk on to coal at the northern boundary of the latter. These exposures are apparently all of the same seam, dipping at 10 degrees to the east, and underlying the grit, and the irregular line of outcrop is caused by the hilly contour of the ground.

At a considerably lower level (about 150 feet below) another seam has been worked to a small extent by a drive at the bottom of the gully on the north of Portion 253, but it is now abandoned. It is apparently one of the lower seams found at Blackstone, and the outcrops in the gully above it up to the grit at the top of the hill shows coaly shales and thin sandstones.

On the eastern boundary of Portion 276, on the Rhondda Estate, a tunnel has been driven at the bottom of a gully into a seam of coal which may possibly be the same, as it is apparently on about the same level, and it has accordingly been mapped as such.

The tunnels and shafts noticed on this area were all part of a system of elaborate prospecting formerly undertaken for the purpose of floating the Cooneana Coal Company, but at the time of my visit they were not in sufficient repair to afford much information as to the nature of the coal exposed. The mapping shows that a considerable area to the east is underlaid by seams which are probably identical with ones which have afforded good coal further to the west, and there is every reason to expect from the exposures seen that the coals are here also of good workable quality.

The mapping places the upper of the two seams on the same horizon as the Four-foot-six Seam found at Blackstone.

The nature of the coarse grit overlying, and the softer sandstone and shales with thin coals between the two seams, resemble very greatly the conditions found at Blackstone, where the Four-foot-six Seam is overlaid by a considerable thickness of grit and underlaid by alternating sandstones and shales with coal seams. This, together with the general dip and strike of the strata traced round the southern boundary of the Cooneana Estate, render it probable that the position of the seams is as mapped.

North of Cooneana the strata are too little exposed to afford much definite information as to the positions of the seams. The beds over Portions 272, 253, 254 and the eastern parts of 255 and 256 are practically horizontal, and consist of soft sandstones and shales belonging to the lower series below the coarser beds. Along a line to the north-east of this they are bent sharply over and dip at steep angles into Stafford's Tunnel Fault, which separates the mines around Dinmore from the rest of the East Ipswich Area.

6. *Stafford's Tunnel Fault.*—The tunnel driven by Mr. Stafford on coal near the north-east corner of Portion 256, following the dip at 23 degrees to the N.N.E., has been referred to before as meeting a fault by which the coal was completely cut off at about 30 yards from its mouth. In the gully on the north-west corner of Portion 267 sandstones are seen dipping at 43 degrees to the N.E., while within sight a few yards to the north sandy shales are dipping south at an angle of about 3 degrees. This point gives the line of the fault, which can be traced south-eastwards across Portions 267 and 271 by the dip of the upturned strata, and is made evident again on Portion 270 by the opposing dips in the bed of a watercourse.

This fault, the downthrow of which is to the north-east, is supposed to be a continuation of that seen at Gilliver's Cutting on the railway line abreast of Portion 252 At this place sandstones and shales are seen in the cutting dipping from both sides into a space filled with a plug of basalt. This has apparently been a fissure from which the basalt found to the north has been extruded, and the basalt in the fissure on consolidating and cooling has contracted and drawn down the beds on both sides. There is no evidence to show that there has been any greater displacement of the strata here than this.

This fissure is perhaps sufficiently in a line with Stafford's Tunnel Fault and the New Chum Fault, the latter of which is more particularly described under the New Chum Mine, to be regarded as a continuation of them. The positions of the Stafford's Tunnel and New Chum Faults as shown on the map are seen to converge in the direction of Gilliver Cutting, but the intervening ground is covered by alluvium, and the workings of the Whitwood Mine are not sufficiently developed to demonstrate their identity with the Gilliver Cutting Fault.

V.—THE COAL SEAMS IN THE NEIGHBOURHOOD OF DINMORE.

1. *General Disposition of the Beds.—The New Chum Seam.*—This area is bounded by Stafford's Tunnel fault on the S.W. and the Ebbwvale Fault on the N.E. The New Chum Seam, which outcrops on the east in the gullies leading into Six-mile Creek, has been shown by the mine workings to underlie the whole area between the faults, as far, at least, as the western boundary of Portion 140. It is at present the only seam worked in this area, and has been reached at various depths by the following shafts :—

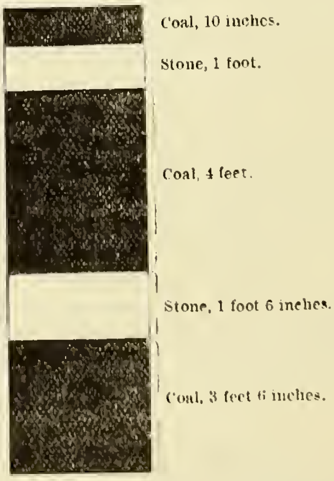
		Feet.
New Chum No. 1,	portion 264	210
New Chum No. 2,	„ 264	197
New Chum No. 3,	„ 266	210
Ebbwvale No. 1,	„ 262	187
Whitwood,	„ 258	244
Dinmore No. 1,	„ 140	215
Dinmore No. 2,	„ 140	115

The surface of the ground falls away to the north towards Dinmore and to the east towards Six-mile Creek. The seam dips at low angles, generally from south to west, and the the general fall may be taken to be about S.W at a gentle inclination.

Numerous faults have been disclosed by the mine workings in this area of up to 100 feet or more in displacement, which have proved very serious obstacles to the economical working of the coal. A few of the larger and better known ones are shown on Map 1. They will be referred to more particularly in treating of the mines.

The New Chum Seam, as a rule, affords from 4 to 5 feet of good steam coal, but its thickness is very variable. It is not used for coking. Fig. 10 gives a generalised section of the seam as seen in the Dinmore Colliery.

Fig. 10.



Section of New Chum Seam in Dinmore Colliery

The centre 4 feet has been mostly worked in this mine, but in places the lower 3 feet 3 inches is worked. At the Whitwood Mine, what is known as the bottom coal, of about 4 feet 6 inches, is generally worked, while from 20 to 30 feet above is found the top coal, the intervening strata being composed of bands of coal and stone. In the Ebbwvale and New Chum Mines the workable thickness of the coal runs to about 4 feet 6 inches.

2. *New Chum Colliery.*—The New Chum Seam was first worked from tunnels driven north, west, and south into the outcrop found in the gullies which converge together on the eastern boundaries of Portions 264 and 265. The seam here dips gently to the south-west. Later on shafts Nos. 1 and 2 were sunk, further to the west, and the workings extended from them into Portions 260 and 266. These tunnels and shafts have since been abandoned. The shaft is thus referred to by Mr. Fryar, as quoted in "Geology and Palæontology of Queensland and New Guinea," page 345:—

"*New Chum Shaft.*—At Bundanba there is a colliery worked by a pit (New Chum Shaft), the property of Mr. Gulland. The shaft is about 220 feet deep, tapping two seams, the lower one of which only is worked. The latter shows in all about 27 feet of carbonaceous matter, but of this 4 feet to 4 feet 8 inches is good, clean coal, without any partings or shale. The dip is about 1 in 9, a little east of south. It is a good, firm, shining coal, with much mother-of-coal in the partings; yet it does not soil the fingers as much as other coals on this field. It is entirely sold for steam purposes, with the exception of the slack, which finds a ready market for smiths' work."

The drive going north from the outcrop on Portion 264 met with a fault, which intersects the boundary road between Portions 564 and 215, and is no doubt a continuation of the Ebbwvale Fault found cutting across the south-west corner of Portion 262 in the Ebbwvale Mine. The fault was never penetrated from these workings.

The workings to the south-west from the No. 1 Shaft drove up against a fault which cut off the coal to the south. This fault is no doubt a continuation of that seen at the entrance to No. 4 Tunnel, in the north-west of Portion 268, where the New Chum Seam is driven into on the south side of a gully heading east, it having been thrown up here to near the surface. The coal is distinctly seen at the mouth of this tunnel, cut off by the fault hading north, it being replaced by sandstones that have been brought down against it. This is the New Chum Fault referred to before.

This No. 4 Tunnel, as shown by the plan of the workings deposited with the Mines Department, was extended to near the southern corner of Portion 269, and levels were driven east and west. The dip of the coal over this area is almost due south, and is about 5 degrees at the mouth of the tunnel.

The workings to the west from the No. 2 Shaft met with inferior coal, it being replaced, as I understand from Mr. Archibald, the late manager, by clayey matter. A similar occurrence is also seen in the eastern workings of the Whitwood Mine on Portion 269. Here clayey matter, which comes in as thin interbedded bands, quickly thickens, while the carbonaceous matter thins out till the whole seam is represented by a deposit of white tenacious clay. The zigzag line on the map represents roughly the southern boundary of this area of clayey matter, which is apparently continuous between the workings of the two mines, as far as I could ascertain it from the information supplied. It is locally known as the "Clay Fault."

In order to work the coal from the centre and west of portion 266 No. 3 Shaft was sunk in the position shown on the map. Faults were met with both in the shaft and on opening out the coal in the immediate vicinity, which have entailed considerable expense in the working of the coal.

About four chains to the north of the shaft the coal is cut off by a large fault hading to the north, and abuts against a wall of sandstone brought down against it. Mr. Jefferies, the manager of the mine, was putting in an inclined drive through this sandstone in order to reach the coal below it, but had not yet penetrated it when I visited the mine. This fault I take to be the western continuation of that above called the New Chum Fault. Apparently the same fault is found again further west at several points in the workings to the south of the Whitwood Shaft on Portion 258 and 259.

3. *The Whitwood Colliery.*—The New Chum Seam is worked by Messrs. Stafford Bros. from the Whitwood Shaft, on Portion 258, at a depth of 244 feet, the workings from which extend over Portions 226, 227, 228, 229, and 259.

An inclined adit from the surface to the seam passes through 50 feet of shales, 80 feet of white sandstone, 60 feet of shales, and 30 feet of coaly shales before reaching the upper portion of the seam. The coal dips gently to the S.W.

In the workings to the south the coal was cut off by a fault hading to the north, which, as shown on the surveyed plans of the mine, runs in an east and west direction along the southern boundary of Portions 258 and 259. This, as mentioned before, is probably a continuation of the New Chum Fault, and has been mapped as such. Other smaller faults found in the workings dislocating the seam with a general east and west trend are shown on the map.

4. *The Dinmore Colliery.*—The Dinmore Colliery, lying north of the railway line on Portion 140, is worked by the Swanbank Colliery Company. The main shaft near the railway line reached the New Chum Seam at 215 feet, and the workings were extended south till they met those from the Whitwood Mine under the road. The coal here dips at about 1 in 7 to the south.

The coal is cut off immediately to the north of the shaft by an east and west fault which throws the coal up 100 feet. The New Chum Seam has been extensively worked to the north of the fault at this higher level—that is, at 115 feet in the shaft—and a second shaft has been sunk 12 chains to the north of the main shaft, and is used as an upcast. Numerous small faults have been met with in the mine, the largest of which runs east and west, about 6 chains north of the large fault previously noted, and develops a throw of about 40 feet in the eastern workings, pinching out almost entirely on the west.

Fig. 3, Plate I, is a section on line G.H. through this and the Whitwood Colliery and shows the faulting of the coal north of the Dinmore Shaft.

5. *The Ebbwvale Colliery.*—The Ebbwvale No. 1 Shaft was sunk to catch the New Chum Seam on Portion 262. A seam of coal was struck at 100 feet and worked to some extent, but was of inferior quality. To the south-west of the shaft a fault was met with, hading to the south-west, and apparently throwing the coal down in that direction. A second seam was met with in the shaft at 313 feet, but was not of sufficient value to warrant extensive working. Apparently neither of these two seams is the New Chum Seam, but they are lower seams brought nearer to the surface by the fault. No. 2 Shaft was accordingly sunk to the south-west of the fault and met the New Chum Seam at 180 feet, and from it the seam was worked from the south-western corner of the portion. Having obtained the right to work the coal from Portion 261 the proprietors then drove through the fault from the No. 1 Shaft, and at present all the coal is being obtained by means of this shaft.

The Ebbwvale Fault, the position of which taken from a surveyed plan by Mr. T. O'Connor, Licensed Surveyor, kindly lent me by Mr. Jones, one of the proprietors, is evidently a continuation of the fault noticed before as cutting off the coal in the workings to the north of the outcrop of the New Chum workings on Portion 264. I have not been able to trace it at any other point, though it is evidently a fault of some magnitude. It apparently throws the New Chum Seam out entirely to the north-east, as neither of those found to the north-east of it resemble in any way the seam found to the south-west.

Fig. 2, Plate I., a section along the line E.F. on Map 1, through the New Chum No. 3 and Ebbwvale Shafts, shows the dislocation of the coal by the Stafford's Tunnel, the New Chum and the Ebbwvale Faults in the workings of the New Chum and Ebbwvale Mines.

6. *The Old Aberdare Seam.*—At about 200 feet above the New Chum Seam in the New Chum No. 3 and No. 2 Shafts is found the old Aberdare Seam. It is found cropping out above the New Chum Seam in the gullies to the east of Portions 264 and 265, and has been traced from there west through the village of New Chum. Its outcrop is also found in Portions 266, 267, and 269, south of the New Chum Fault by which it is brought to the surface again. It was formerly worked by a drive from the latter outcrop striking south from the north-west corner of Portion 267, by Mr. Thomas, of Blackstone. This appears to be the seam referred to by Mr. A. C. Gregory as quoted by Mr. Jack in the Geology and Palæontology of Queensland, page 335, "Thomas's Mine."* "At this point Thomas's Mine has been opened on Portion 270, Parish of Goodna, the workings being on a dip of 15 degrees to the south for 150 yards. The thickness of the seam is about 6 feet, of which 4 or 5 feet are available, as there are some bands of clay and shale which vary considerably in thickness. The coal from this seam is hard and bright, and bears carriage better than the average of the district, while it is in good repute as a steam coal. The specific gravity is 1·44.

Volatile in coking	29
Fixed carbon	57
Ash	14
	100

It makes a fair coke, but not equal to that from the coals found further to the west near Ipswich. About 200 yards to the east of Thomas's Mine the coal crops out in a gully."

This mine is now abandoned, and the seam has not since been worked.

It may be noted that the workings are described as being on Portion 270, but the tunnel is really on Portion 267 to the north. The workings probably extended into Portion 270.

I have found it quite impossible to correlate with certainty the New Chum Seam with those found at Bundanba or on Cooneana, but the strata appear to resemble more closely the lower series of softer sandstones and shales found at Bundanba and Blackstone, and to place the New Chum Seam on the same horizon as those worked in the Braeside Colliery.

VI.—CHARACTERISTICS AND COMMERCIAL VALUE OF THE WEST MORETON COALS.

1. *Analyses and Tests, with Tables and Notes.*—Appended are two tables, which will be of service in forming an opinion on the qualities and commercial value of the coals from the West Moreton Field. Table I. gives a list of the analyses of 6 coals from south of the Bremer, of 5 from north of the river, of 1 from Walloon, and for purposes of comparison, of 4 from the Burrum Coal Field. These analyses were made at the Government Analyst's Office, on samples from exhibits at the Queensland International Exhibition, 1897. Following are means of percentages of the constituents of 14 coals from Newcastle District, N.S.W., of 7 from the Bulli District, of 17 from Newcastle (England), and of 31 from Wales—the figures being abstracted from tables given in "Mineral Resources of N.S.W.," published by the Department of Mines of that Colony. Table II. gives the results of a series of experiments on the steaming powers of 5 coals from south of the Bremer, 2 from north of the Bremer, 1 from the Darling Downs, 2 from the Burrum Field, 1 from the Newcastle District, N.S.W., and 1 from the Bulli District, N.S.W. These experiments were made on the Government steamer "Otter," in 1892, by Mr. Robert Wilson, Engineer, under the authority of Sir Horace Tozer, then Colonial Secretary. A few notes made by Mr. Wilson on the physical character and behaviour in the furnace of each of these coals accompanies the table. A paper dealing with the results was read by Mr. Wilson before the Queensland Institute of Mechanical Engineers, and through his courtesy I am enabled to publish the paper in full as an Appendix. It will aid those wishing to judge of the commercial value of the West Moreton coals in forming an independent opinion as to their suitability for steaming purposes.

2. *Difference between the Coals from North and South of the River—The Walloon Coal.*—The coals from north of the Bremer River contain a considerably higher proportion of fixed carbon and ash than those from south of the river. They cake well, giving excellent coke, but are not, as a rule, so suitable for steam purposes. The coals from south of the river contain much less fixed carbon and ash, with correspondingly more hydrocarbons, and do not cake sufficiently well to give good cokes, but are more suitable for steam purposes. The Walloon coal is of an entirely different appearance and character, containing only 47·94 per cent. of fixed carbon, and a correspondingly higher percentage of volatile hydrocarbons. It makes an excellent gas and household coal, burning very freely with a bright luminous flame. It contains much less mother-of-coal, the main portion being hard and lustrous, and showing no cleavage, but breaking easily with a conchoidal fracture. It does not soil the fingers.

3. *Comparison of Analyses with those from New South Wales.*—The analyses show that the composition of the West Moreton coals is intermediate between those of coals from the Newcastle and Bulli districts of New South Wales. The mean of percentages of fixed carbon in 7 samples from the Bulli district is 67·23, and that of 14 samples from the Newcastle district is 56·51. The minimum for the Bulli coal is 64·65, while the maximum for the Newcastle coal is only 59·56. The mean of 7 from south of the Bremer River and 5 from north of the river both lie between these two latter figures, being 60·78 and 63·59 respectively. Similarly the mean of percentages of ash in the Ipswich coals lie between those of the two New South Wales Fields. Professor Liversidge of the

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Report on the Coal Deposits of the West Moreton and Darling Downs District. Brisbane: By Authority.

Sydney University gives the mean of 42 ash percentage of samples of Newcastle (New South Wales) coals at 6·80, but this probably includes some specimens of outcrop coal in which the ash percentage is abnormally high.*

4. *Ash Percentages.*—In ash percentages, then, the Ipswich coals do not compare unfavourably with the New South Wales coals. This character, however, is not maintained in the steamer trials, except in the case of the Aberdare coal, which compares very favourably with the New South Wales coals in this respect, the unburnt residuum being in all other cases considerably higher. This is perhaps accounted for, first, by the fact that the Aberdare Seam has an ash percentage below the average of the other West Moreton coals, and, secondly, by the fact that the seam is freer from bands of stone than the other seams of the district, and so can be put on the market in a cleaner condition. The superiority of the Aberdare Seam as a steam coal is also shown in Table II. by its high calorific and evaporative power. The New Chum Seam comes next in order of merit in the steamer trials. Mr. Wilson deals with the question of impurities in the coal in his report (Appendix, page 27), and suggests that if more care were exercised in placing the West Moreton coals on the market in a cleaner condition their qualities would compare very favourably with the southern coals. This is no doubt a matter of difficulty in many cases in the present state of development of the mines owing to the frequent bands of stone in the seams and the fact that the owners cannot afford to erect expensive machinery or employ the necessary labour to thoroughly clean the coal, but it is a drawback which will no doubt be lessened to a considerable extent as the mines become better developed and the working capital of the owners increases.

5. *Friability.*—The friability of the Ipswich coals is an often-raised objection to their taking a good position as bunker coal. Mr. Wilson makes light of this objection in his paper, as he says the small of the coal cakes well in the furnace, and does not entail as much waste from its falling through the bars as might be expected (Appendix, page 25). Judging from the evidence available it seems certain that the Ipswich coals are of very high commercial value as fuel, and that a considerable increase in output is to be expected as the demand for industrial purposes becomes greater.

TABLE I.

Analyses of Coals.

——	Moisture.	Volatile Hydrocarbons.	Fixed Carbon.	Ash.	Sulphur.
Coal from South of Bremer River, West Moreton District—					
1. Aberdare Seam, Blackstone	1·74	33·10	60·64	4·52	·742
2. Braeside, Bundanba No. 4 or Hard Seam	1·15	31·20	59·10	8·55	·592
3. Braeside, No. 1 Seam	1·81	29·98	59·23	8·98	...
4. New Chum Seam, Whitwood Colliery	2·07	30·50	64·13	3·30	·811
5. New Chum Seam, Dinmore Colliery	1·05	28·70	60·07	9·55	1·68
6. No. 2 Seam, Swanbank Colliery	2·10	29·65	59·95	8·30	1·68
Mean of Values	1·65	30·52	60·52	7.20	1·101
Maximum	2·10	33·10	64·13	9·55	1·68
Minimum	1·05	28·70	59·10	3·30	·592
Coals from North of Bremer River, West Moreton District—					
1. Tivoli Seam, Wright's New Tivoli Colliery	2·50	23·40	53·05	21·05	1·07
2. Tivoli Seam, Waterstown Colliery	·55	28·00	66·00	5·45	1·29
3. Bishop Seam, Bishop Colliery	1·15	24·75	72·69	1·41	1·01
4. Bishop Seam, Donnybrook Colliery	·95	25·60	62·05	11·40	1·25
5. Haighmoor Colliery	1·10	27·15	64·15	7·60	1·69
Mean of Values	1·25	25·78	63·59	9·38	1·26
Maximum	2·50	28·00	72·69	21·05	1·69
Minimum	·55	23·40	53·05	1·41	1·01
Coal from Walloon—					
Wright's Caledonian Mine	4·70	38·08	47·94	9·28	1·50
Coals from Burrum Coal Field—					
1. Torbanlea	3·25	25·20	58·40	13·15	1·72
2. Howard	1·40	28·15	65·40	5·05	1·37
3. Wright's Burrum	1·48	26·25	70·72	1·55	·769
4. New River Bank	1·10	27·50	69·25	2·15	·70
Mean of Values	1·81	26·77	65·94	5·98	1·14
Maximum	3·25	28·15	70·72	13·15	1·72
Minimum	1·10	25·20	58·40	1·55	·70
Coals from Northern or Newcastle District, New South Wales—					
Mean of 14 samples	2·25	35·25	56·51	5·00	·91
Maximum	2·75	41·10	59·56	7·80	1·46
Minimum	1·65	32·60	54·12	2·72	·49
Coals from Southern or Bulli District New South Wales—					
Mean of 7 samples	1·09	20·84	67·23	10·25	·61
Maximum	1·61	23·51	69·84	11·28	·99
Minimum	·65	18·22	64·65	8·76	·28
Coals from Newcastle, England—					
Mean of 17 samples	36·44		59·74	3·82	1·24
Maximum	43·80		...	9·12	2·85
Minimum	26·91		...	·20	·06
Welsh Coal—					
Mean of 31 samples	21·15		74·70	4·15	1·34
Maximum	37·63		...	11·37	3·42
Minimum	9·57		...	1·62	·64

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* Minerals of N.S.W., by A. Liversidge. London: Trübner & Co.

TABLE II.

RESULTS of ENGINE TESTS of COALS made on the GOVERNMENT S.S. "OTTER," by Mr. ROBERT WILSON, ENGINEER, during Years 1891 and 1892.

Tests made in 1891 and 1892.		Duration of Coal trial.		Weight of Coal burnt, in lbs.	Weight of Coal consumed per sq. foot of fire-grate per hour.	Duration of Feed-water trial.		Total Weight of Feed-water.	Weight of Feed-water evaporated per sq. foot of fire-grate per hour.	Indicated Horse-power of engine.	Coal consumed per indicated horse-power per hour.	Amount of Water evaporated per lb. of coal consumed.	Amount of Water evaporated from and at 212° F. per lb. of coal consumed.	Calorific Value of each lb. of Coal as burned.	Mechanical Energy of each lb. of coal in foot lbs.	Mean Pressure of Steam.	Mean Temperature of Steam.	Mean Temperature of Feed-water in degrees Fahrenheit.	Percentage of Unburnt Residue.
		Hrs.	Mins.	Lbs.	Lbs.	Hrs.	Mins.	Lbs.	Lbs.	H.P.	Lbs.	Lbs.	Lbs.	Units of Heat.	Foot lbs.	Lbs. per Sq. Inch.	Degrees F.	Degrees F.	
1. Aberdare Seam, in Aberdare Colliery, Blackstone	Seams south of Bremer River. (See also No. 13.)	9	50	9,450	19·6	8	45	60,726	140·2	408	2 375	7·16	8·027	7,759·292	5,990,173·242	87	329	130	13
2. Aberdare Seam, in West Moreton Colliery, Blackstone		4	55	4 760	19·5	2	30	16,456	139	422·8	2·292	7·167	8·178	7,904·873	6,107,561·956	88	330	125	15
3. New Chum Seam, in Whitwood Colliery, Dinmore (Compare No. 14)		4	55	5,916	20·2	5	55	40,499	138·28	407·6	2·45	6·845	7·683	7,426·842	5,623,215·455	85·5	327·5	128·6	17
4. Day Dawn Colliery, Bundanba		4	43	4,884	20·844	4	43	32,182	137·44	419	2·462	6·57	7·4	7,163·928	5,308,522·00	85·2	328	123	20·5
5. Borehole Colliery, Blackstone		4	35	4,760	21	4	35	29,688	130·9	409·06	2·513	6·237	7·02	6,783·856	5,238,680·8	85	328	125·4	18·2
6. Waterstown Seam, Waterstown Colliery	Seams north of Bremer River.	4	53	5,320	22	4	53	33,037	136·8	412	2·54	6·214	7·0226	6,788·04	5,240,374 075	87·5	329 6	121·5	19·5
7. Bishop Seam, in Donnybrook Mine...		5	0	5,329	21·53	5	0	35,664	144·1	423·716	2·575	6·69	7 54	7,294·776	5,588,567·000	85	328	123	19
8. King and Son's Coal, Gowrie, Darling Downs		8	44	8,845	20·53	8	44	63,165	146	426·5	2·38	7·14	8·04	7,771·6	5,999,678·59	87·4	329·2	125·3	11·6
9. Coal from Isis Investment Company, Burrum Coal Field ...		7	44	8,120	21·21	7	44	57,264	149·5	428·882	2·4	7·052	7·955	7,689·500	5,936,294	86	328	123	18
10. Coal from Queensland Collieries Company, Burrum Coal Field		7	20	7,140	20·06	7	20	51,620	144·8	421·85	2·171	7·23	8·146	7,874·193	7,078,876	85·6	328	124·6	17
11. Dukinfield Coal, New South Wales...		7	2	7,035	20·2	7	2	50,863	146·5	442·6	2·253	7·23	8·122	7,950·7	6,137,940·4	87	329·6	123·85	13·3
12. South Bulli Coal, New South Wales		7	2	6,547	18·23	7	2	47,740	133·0	...	2·33	7·292	8·043	7,774·36	6,002,805·9	85·25	327·6	122·66	14·5
13. Aberdare Seam, in Borehole Colliery (aggregates and means of four trials)		11	50	12,920	...	...		88,240	...	...	...	6·822	7·686	7,429·158	5,735,309·87	55·75	328·3	124·45	20·5

Notes written by Mr. Robert Wilson on Coals from which the foregoing results were obtained.

No. 1.—This coal is a soft friable coal, fairly heavy, the friability, however, does not seem to interfere much with its steaming qualities. It is a coking coal, very uniform in quality, burning in the furnace with a long clear flame and giving off a very good heat. It is a fairly fast steaming coal very suitable for marine purposes as it leaves no clinker on the firebars, the only residuum being a light white ash.

In working this coal I keep the fires fairly heavy, using the T-head slice to keep the firebars clear, the fires also require breaking up from time to time as the coals coke in the furnace.

No. 2.—I found this to be a coal similar in some respects to that supplied by Mr. Lewis Thomas; it is of the same friable nature, the amount of small coal in a given quantity being considerable. This coal is a good steaming coal; it burns with a very good clear flame giving off a strong heat, and is very easy to work in the furnaces as it stands a lot of knocking about. With this coal I usually keep heavy fires, using the T-head slice to keep the bars clear, and the bar slice to break up the fires with when the coals coke.

This coal leaves a light grey ash and a small brown clinker; the clinker, however, does not stick to the firebars.

No. 3.—This coal is a bituminous coal, having a bright pitchy appearance. Like most Queensland coals, it is very friable, with an uneven cleavage.

In working this coal the smallness of some of it did not appear to affect its steaming qualities. It cakes very well in the furnace and burns with a long clear flame; it seems to be a coal that would work very well with an artificial draught. It leaves a light white ash with a small percentage of free clinker.

My mode of working the fires with this coal was to work them rather heavy, sprinkling the coals at short intervals so as to keep the fires always bright, using the T-slice to keep the firebars clean and the bar slice to break up the fire when the coal caked too much; the rake was very seldom used.

No. 4.—This coal presents a fairly good appearance when looked at in the bulk. Individual pieces, however, when closely examined, show clay bands and other impurities running through them. It is of the usual friable nature peculiar to West Moreton coals, is fairly heavy, and has a better cleavage than some of the varieties.

In the furnace the coal burns very well, giving off a good heat with a clear flame. The large percentage of ashes and clinker is, however, a great drawback, and is very detrimental to its value as a fuel for continuous steaming.

In working the fires I kept them a moderate thickness, using the T-head slice to keep the bars clear. The ash given off is a light ash with a small brown clinker that does not stick to the firebars.

No. 5.—This is a dull-looking coal, the larger pieces being streaked with grey, and looking as if they had been washed with clay water. It is of the friable nature, there being a large percentage of small amongst it.

In the furnace the coal burns fairly well, the flame being long and moderately bright, it also cakes to a certain extent, but not so much as some of the other coals from the same district. I worked the fires fairly heavy, using the bar slice to break them up, and the T-head to keep the firebars clear.

The large amount of ashes and small clinker given off by this coal is a great drawback to its value for continuous firing, the fires can only run six or eight hours without cleaning.

No. 6.—This coal presents many of the characteristics peculiar to most of the West Moreton coals. It is very friable, the cleavage is very uneven, and clay bands appear to be the principal impurity. Its steaming power is not of a very high order when compared with several of the other West Moreton coals. In burning the coal gives out a light white ash along with a small brown clinker, the clinker showing traces of iron.

In working this coal I have found it best to keep the fires fairly heavy, using the T-head slice to keep the bars clean. This coal does not cake so much as some of the others from the same district. The flame is long and moderately clear.

No. 7.—This coal is a dull-looking, heavy coal, mostly very small. This smallness, however, appears to be more of a benefit than otherwise, as I got it to burn fairly well; the big coal, however, would not burn unless subjected to a very strong heat. In the furnace the coal burns with a long clear flame, and lasts very well. Like most West Moreton coals it cakes fairly well. The principal impurity seems to be sand; the percentage of ashes is large; it is of a heavy nature, dark in colour, containing sand and traces of iron. The amount of clinker is small; it does not stick to the bars.

Working with this coal I kept the furnaces well charged, using the bar slice to break the fires up with in preference to the T-head slice.

No. 8.—I found this to be a coal differing very much from the general run of the Queensland coals that I have tested; it is a bituminous coal of light specific gravity; it is fairly hard with a good even fracture; it has a clear pitchy appearance, and resembles some of the North of England coals. The sample received was very free from dross; there was, however, no large coal amongst it; it very much resembled the class of coal called nuts.

I found this a remarkably fast steaming coal, and could keep a good head of steam with it without any trouble.

In working this coal in the furnaces I kept the fires a medium thickness, putting on small fires and firing often. It leaves a very good ash, but no clinkers of any size.

This coal burns with an intense local heat, which may be a source of trouble with certain classes of boilers if they are not carefully looked after.

No. 9.—I found this a coal presenting some of the characteristics of Welsh coals. It is a very friable coal with a large percentage of small amongst it. A coal that burns slowly with a good heat and a clear flame, it cakes fairly well in the furnace, but will not stand knocking about. In burning it leaves a light white ash, and deposits a hard clinker on the firebars that requires removal with the prickers.

The fires are best when they are worked thin with constant attention and light firing, the working to be similar to that necessary for some kinds of Welsh coals.

With a fresh wind this coal gives very good results. It appears to me that it would do very well for land boilers having a good draught and a moderate consumption of fuel per square foot of firegrate, but I do not think it is so suitable for marine boilers, where a high duty is required from each square foot of firegrate with only a moderate draught, and at the same time continuous steaming.

No. 10.—I found this coal possessing many of the qualities peculiar to the coals from the Burrum District. It is a friable coal, burns slowly in the furnace with a good local heat, and will not stand much knocking about. There is a large percentage of small, but it seems to burn well enough.

I found the fires to do best when they were kept to a medium thickness, and fired lightly and often. When burnt, this coal leaves a brown ash and a thin clinker that sticks to the bars. There is a certain amount of iron in this clinker that makes it heavy on the bars.

This coal has the same fault as the other Burrum coal I have tried—*i.e.*, owing to the large amount of clinker that accumulates in the furnace after a few hours steaming. It is not so well adapted for continuous firing as some of the other Queensland coals that have been tested by me.

No. 11.—I found this to be a semi-bituminous coal; it is fairly hard and looks like some kinds of Scotch coal; it is a fairly fast steaming coal with a moderate amount of clinker and ashes; it looked very well in the furnace, and had to be worked in a manner similar to the West Moreton coals. It burns with a moderately long clear flame, having a good local heat. I worked the fires fairly heavy and had no difficulty in keeping a good head of steam.

No. 12.—This is a hard dull-looking coal, not unlike some Welsh coals in appearance. The pieces of coal are for the most part small in size; there is, however, very little dross amongst it; it cakes very little in the furnace, and will not stand knocking about. It is not a fast steaming coal, burning best with a strong draught, giving a very clear flame with a strong local heat; the ashes are brown with a mixture of small clinker. I worked the fires fairly light, firing often, and using the bar slice to ease up the coals with; this fuel would not force, but had to get its own time to burn.

No. 13.—I found the coal to be dull-looking mineral having, like most of the West Moreton coals, a fair amount of small amongst it; however, it seems to be on the whole harder than some of the samples I have had from the same district.

In the furnace I found it to burn with a long fairly clear flame having a good local heat. Its steaming power is fairly good as is shown by the results obtained. The great drawback to the coal for steaming purposes is the large amount of refuse contained in it; the coal itself is a very good coal. What is wanted is that it should be put on the market with a less percentage of impurities, then I am certain much better results would be obtained from it.

I have worked my fires fairly heavy using the T-head slice to keep the firebars clear and the bar-slice to break up the coals after coking. This coal cokes fairly well.

I may state that the sample I received was from one of the company's punts and was not in any way a picked lot, but rather the opposite, as the part of the punt it was taken from contained more than the average of small coal.

The trials have been made on our usual runs to St. Helena and Dunwich.

APPENDIX.

QUEENSLAND COAL: ITS ECONOMIC VALUE AS A STEAM COAL.

(A Paper read before the Queensland Institute of Mechanical Engineers, December, 1992, by Mr. Robert Wilson, Engineer.)

This paper is written for the purpose of laying before the members of the Queensland Institute of Mechanical Engineers the results of a series of trials that have been conducted by the writer for the purpose of ascertaining the evaporative powers of several of the better known kinds of Queensland coals. In taking up this subject the writer has been actuated by a desire to lay before the members a series of figures, which he hopes will go a long way to prove that the coals of this colony are well able to hold their own with any others at present found in Australia. This may seem a bold assertion to make in the face of the well-known prejudice that exists in many quarters to our coals, but "facts are chiels that winna ding," and before this paper is finished you will have formed the opinion that a very good case has been made out for Queensland. It may here be remarked that this prejudice is in some cases wearing away, as may be seen from the fact that steam users who a few years ago would not have the coals that are supplied here unless they could help it, now use them regularly; indeed several of our fastest coastal steamers get along about as well with Queensland coal as they do with that they get from the southern colonies. Our home mail steamers also now take away large quantities, the R.M.S. "Jelunga," which left Brisbane a few days ago, taking with her some 1,200 tons for bunker use. In testing the various samples every reasonable precaution has been taken to ensure correctness in the returns, and they are placed before you with the fullest confidence in their reliability. The trials have not been made with the view of scientifically determining the ultimate amount of water that each pound of coal is capable of evaporating under the most favourable circumstances and when the surroundings are so arranged that the highest possible result may be obtained. Returns so obtained are very misleading to the ordinary individual, for the reason that they form no index to the value of the coal when subject to the careless usage of everyday working in the furnace. During the whole of the time that the trials were carried on, one point was kept steadily in view—namely, to keep boiler and engines working as nearly as possible under normal conditions. The writer is well aware that in working out coal-trial results there are always certain errors liable to creep in; these errors he has tried as much as possible to eliminate, and where a doubt has existed, the coal has not got the benefit of it; so that on the whole the averages may be considered to be rather under than over the mark. In this way it is felt to be perfectly safe in stating that the coals tried are fully equal to the powers they are given credit for. The trials were all made with an ordinary return multitubular marine boiler, 12 feet 6 inches in diameter and 10 feet long, having three furnaces each 33 inches in diameter and 6 feet long, with a separate combustion chamber to each furnace. This boiler was constructed to supply steam to two pairs of compound surface condensing engines, having cylinders 15½ inches and 30 inches diameter, with a stroke of 20 inches. The pressure of steam carried during the trials varied from 83 lb. to 100 lb. per square inch. The various points attended to during the trials were as follows, namely:—Pressure of steam, horse-power of engines, weight of coal consumed, weight of feed-water pumped into the boiler, temperature of the feed water, and the weight of the ashes. The returns would have been more complete had it been possible to have ascertained the temperature of the furnace and funnel gases, but no apparatus was available for that purpose. The fires were at all times fairly well worked, and at the finish of each trial they were left as nearly as possible in the same condition as they were in at the start. For the purpose of measuring the feed-water, two small tanks were made for each pair of engines. These tanks were connected by pipes to the hot-wells and to the feed pumps, the arrangement being such that when the contents of one tank were being pumped into the boiler the other tank was being filled from the hot-well. The exact amount of water the tanks held was ascertained by actual weighing, so that a tally of the number of times they were filled during a given time showed the weight of water pumped into the boiler. The coals were carefully measured out for each trial, the same being done with the ashes. The height of the water in the gauge-glass of the boiler was always kept as uniform as possible. It was explained that the refinement of returning the ashes or of separating the unburnt fuel from them had not been gone into. When coals are worked about in a furnace a large proportion of the stuff that falls through the bars consists of unburnt small coal. This small coal and also the cinders are measured out along with the ashes pure and simple, and so make the return much larger than it otherwise would be. The coals tested have been obtained from five different coalfields, each kind of coal presenting different characteristics, and requiring a different mode of treatment. In all, twelve different samples have been tested; seven from the West Moreton Coal Field, two from the Burrum Coal Field, one from the neighbourhood of Toowoomba, one from New South Wales from a field north of Sydney, and one from New South Wales from a field south of Sydney. The New South Wales coals were tested, so that a standard of comparison could be formed. Before a sample of coal has been tested inquiry has always been made as to the best modes of working it in the furnace, and in all cases the instructions received have been as closely as possibly acted up to. The boiler had always been worked as uniformly as possible, the engines each time being set with the same grade of expansion, the power given out varying from 407 horse-power, the coal being burnt at an average rate of 20 lb. per square foot of firegrate per hour. It may be objected that this is too high a rate to burn at, and that to make it uniform for all coals, does not give some of them a fair chance. That may be so; but it must be remembered that in these days of push and drive, the only matter the engineer considers is how to get steam out of a boiler, the question of giving coal time to burn properly or economically is seldom or ever thought of. Well knowing this to be the case is the reason why the work has not been made to fit the coal—on the contrary, one of the aims of the experiments has been to determine the value, and behaviour of the coals when made to fit the work. Had the trials been made with furnaces burning from 12 lb. to 16 lb. of coal per square foot of firegrate per hour, the returns would have been higher, but they would not have been so reliable for marine purposes. It is not intended to individualise the several coals operated upon. They will be grouped together as follows:—The West Moreton coals will be divided into two groups; the Burrum coals will be treated as one group; while the other coals—all coming from different fields—will be treated singly. Of the seven coals from the West Moreton District, three may be put in the front rank, and may be classed as very good steaming coals. They are all bituminous coals, coking well in the furnaces, giving off a long clear flame with a good heat. They leave behind a white ash, with a proportion of brown clinker, that does not stick to the bars; indeed, one of the samples does not show any clinker in the true sense of the term. They all seem to be very free from sulphur, showing them to be first-class coals for forges, blast-furnaces, and other metallurgical processes. The Hon. A. C. Gregory, C.M.G., writing as far back as 1876, says of the West Moreton coals: "In the Ipswich division the coals are bituminous, coking well; the proportion of gas being small and the fixed carbon large, they are suited for forges and blast-furnaces; are good steam coal when not broken too small, but are so friable as not to bear carriage well; and suffer from exposure to wet. So that the harder varieties, though containing most ash, are found in practice to be the most economical, in consequence of the smaller proportion of waste." The above opinion the writer has found to be very correct, in the main, but he does not attach so much importance to the friability of the coal as Mr. Gregory seems to do, his (the writer's) experience teaching him that the size of the coal makes very little difference in its steaming power; indeed, in some cases he has found that the small coal was more free from impurities than the large coal, and burned better. The following are the results obtained from the three West Moreton coals placed in the front rank:—Mean pressure of steam, 86·83 lb. per square inch; mean temperature of steam 328·80 degrees F.; mean temperature of feed water, 127·8 F.; mean weight of water evaporated per lb. of coal consumed, 7·06 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 7·96 lb.; mean weight of water per indicated horse-power per hour, 16·74 lb.; mean weight of coal burnt per square foot of firegrate per hour, 19·63 lb.; mean percentage of ashes, 15 per cent. The remaining four samples grouped together gave the following results:—Mean pressure of steam, 86 lb.; mean temperature of steam, 328·2 F.; mean temperature of feed water, 123 F.; mean weight of water evaporated per lb. of coal consumed, 6·423 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 7·1 lb.; mean weight of coal consumed per indicated horse-power per hour, 2·543 lb.; mean weight of water used per indicated horse-power per hour, 16·54 lb.: mean weight of coal consumed per square foot of firegrate per hour, 21·425 lb.; mean percentage of ashes, 19·4 per cent. The samples of coal received from the Burrum District were found to possess several features that stamped them as being distinct coals from those of the West Moreton District. In appearance they are not unlike some varieties of Welsh coals, and like Welsh coals they are very friable, with a large percentage of small amongst them. The small, however, seems in most cases to burn well enough. They burn slowly in the furnace when compared with some of the other Queensland coals, giving off a long clear flame, with a good local heat; they coke fairly well, but will not stand much knocking about; they seem to steam best when the fires are kept at a moderate thickness, with constant attention and light firing, the working to be similar to that necessary for some kinds of Welsh coals. When burnt they leave a greyish white ash and a thin clinker that sticks to the firebars; the clinker requires to be removed with the pricker bar. With a fresh wind they give very good results, and appear to be coals that would do very well for land boilers having a good draught, and burning, say, from 12 lb. to 16 lb. of coal per square foot of firegrate per hour. The following are the results obtained from the Burrum coals:—Mean pressure of steam, 85·76 lb.; mean temperature of steam, 328 F.; mean temperature of feed water, 123·815 F.; mean weight of water evaporated per lb. of coal consumed, 7·141 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 8·07 lb.; mean weight of coal consumed per indicated horse-power per hour, 2·375 lb.; mean weight of water used per indicated horse-power per hour, 16·9 lb.; mean weight of coal consumed per square foot of firegrate per hour, 20·73 lb.; mean percentage of ashes, 17 per cent. The sample of coal from near Toowoomba differs in structure and appearance from all the others operated upon It is a cannel coal, fairly hard, of a light specific gravity; when broken it shows a fairly even fracture, with a bright pitchy appearance; in the furnace it burns with a clear flame, and has an intense local heat; it is a very fast steaming coal, and during the trials a good head of steam was kept without any trouble. The fires were kept fairly heavy, the firing being light and often, the slice having to be very little used. This coal leaves a very good ash, but no clinker of any size, the percentage of dirt being less than for any other Queensland coals. The Hon. A. C. Gregory, C.M.G., in his "Report on the Coal Deposits of the West Moreton and Darling Downs district" says that "the general character of the coals found between Walloon and Warwick is that of cannel coal. It does not cake in coking, gives a large percentage of gas, or oil, or parafine, according to its treatment, at a high or low temperature. Its hardness renders it very suitable for export. It burns very freely, and leaves a soft ash. From the small proportion of fixed carbon, and its not caking, it does not produce good coke, but a charred coal, which, however, burns well; consequently it is not adapted for blast furnaces, though well-suited for reverberatory furnaces. As a steam coal it is best suited for stationary or marine engines, the strong blast of locomotives being apt to blow it through the tubes. It is a very high-class household coal." The above description agrees very fairly with the writer's own experience in working this coal. The following are the results obtained:—Mean pressure of steam, 87·4 lb.; mean temperature of steam, 329·2 F.; mean temperature of feed water, 125·3 F.; mean weight of water evaporated per lb. of coal consumed, 7·14 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 8·04 lb.; mean weight of coal consumed per indicated horse-power per hour, 2·34 lb.; mean weight of water used per indicated horse-power per hour, 16·718 lb.; mean weight of coal consumed per square foot of firegrate per hour, 20·53 lb.; percentage of ashes, 11·6 per cent. The New South Wales coal from the Newcastle District was found to be a clear-burning fast-steaming coal. It was fairly hard, and looked very much like some of the Scotch coals. It coked very well in the furnace, and had to be worked in a manner similar to that required for most of the West Moreton coals. In burning it made a grey ash, and a heavy brown clinker that soon choked up the air spaces between the firebars. However, if used in furnaces where only a moderate amount of coal was burnt per square foot of firegrate per hour, it would give very good results The following are the results obtained:—Mean pressure of steam, 8 lb. per square inch; mean temperature of steam, 329·6 F.; mean temperature of feed water, 123·83 F.; mean weight of water evaporated per lb. of coal consumed, 7·23 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 8·122 lb.; mean weight of coal consumed per indicated horse-power per hour, 2·153 lb.; mean weight of water used per indicated horse-power per hour, 16·85 lb; mean weight of coal consumed per square foot of firegrate per hour, 22·2 lb.; percentage of ashes, 13·3 per cent. The other New South Wales coal—that obtained from the south of Sydney—was a coal that in appearance, looked like a Welsh coal. Though a fairly hard coal, it was mostly in small pieces, about the size of a man's fist, there being very little dross amongst it. In the furnace it was found to be a slow-burning, non-caking coal, with a good local heat, and a very clear flame when a good breeze of wind was blowing, but when the wind fell off and the draught decreased they did not do nearly so well. They would do very well with a forced draught. The following are the results of the trials:—In all, I had three trials of this coal. The first and third took place in ordinary weather; the second trial was carried out under very favourable circumstances, as we had a strong head wind to steam against. It has, therefore, been considered best to keep the different days separate, *i.e.*, the first and third day's work will be put together as one return, and the second day's work by itself. You will then be able to judge for yourselves exactly how this particular coal is affected by the intensity of the draught. First and third days' trials:—Mean pressure of steam, 83·5 lb.; mean temperature of steam, 326·33 F.; mean temperature of feed water, 121·125 F.; mean weight of water evaporated per lb. of coal consumed, 7·084 lb.; mean weight of water evaporated from and at 212 F. per lb. of coal consumed, 7·736 lb.; mean weight of coal consumed per indicated horse-power per hour, 2·4 lb.; mean weight of water used per indicated horse-power per hour, 17 lb.; mean weight of coal consumed per square foot of firegrate per hour, 17·4 lb.; percentage of ashes, 15 per cent. Second day's trial:—Mean pressure of steam, 87 lb.; mean temperature of steam, 328·9 F.; temperature of feed water, 124 F.; weight of water evaporated per lb· of coal consumed, 7·5 lb.; weight of water evaporated from, and at 212 F. per lb. of coal consumed, 8·35 lb.; weight of coal consumed per indicated horse-power per hour, 2·26 lb.; weight of water used per indicated horse-power per hour, 16·95 lb.; weight of coal consumed per square foot of firegrate per hour, 19·06 lb.; percentage of ashes, 14 per cent. Through the courtesy of the Acting Chief Engineer for Harbours and Rivers, Mr. J. Vaughan Stewart, the following results of tests made with the Queensland and New South Wales coals by means of Mr. Lewis Thompson's calorimeter, or fuel tester, have been placed at the writer's disposal. As you will be shown the machine in action further on in the evening, the following short description of it, copied from Professor Jamieson's textbook on the steam engine, may be of interest to you:—"Principles on which the calorimeter is based—first, that the latent heat of the steam is equal to 966·6 (or in round numbers 967) British units of heat; and, secondly, that coal burnt in pure oxygen evolves the same amount of heat as when *perfectly* burnt in atmospheric air." Thus it follows that if we heat or raise 967 parts (by weight) of water 1 F., we have employed as much heat as would have boiled one part (by weight) of water from 212 F. If the same quantity of water had been heated 10 F., then we have used heat equivalent to boiling off 10 parts, and so on, the thermometer being used to indicate in this way the number of parts of water capable of being boiled off by the heat generated by the perfect combustion of the fuel. As 1 lb. of coal is an inconveniently large quantity of fuel to use with such an apparatus, it has been specially designed for burning 2 grammes of fuel at a time. From the above it will be observed that, if we contrive to thoroughly burn 1 gramme of fuel in the midst of 967 grammes of water, the increased temperature of the water will show us the number of grammes of water which 1 gramme of this fuel in question is able to convert into steam 212 F., and we at once come to the evaporative value of the fuel. As it has been found advisable to use a larger quantity of coal or other fuel than 1 gramme, the apparatus is specially designed (as we have just remarked) for 2 gramme quantities, and, of course, for a corresponding quantity of water—viz., 967 × 2, or 1,934 grammes. As the weight of fuel burned and of water used are directly proportional to the latent heat of steam, the indications of the apparatus are general and may be expressed in any weights whatever—*e.g.*, in pounds of water boiled off per pound of coal. It may be stated that this machine, though dealing with such small quantities, has been found to be very reliable, and the results shown by it are generally correct. As a proof of that the machine has been adopted by the Home and various other European Governments, and also by several of the great railway companies, who all use it to determine the relative commercial value of the coals they purchase. The following theoretical values of Home coals have been taken from "Seaton's Manual of the Marine Engine," and when compared with the results obtained from the calorimeter will be found to be very instructive. Average Welsh coals, 15·52 lb.; average Newcastle (Eng.) coals, 15·32 lb.; average Lancashire coals, 14·56 lb.; average Scotch coals, 14·65 lb. These values represent the evaporative powers of the coals in pounds of water from and at 212 F. Mr. F. W. Hartley, A. Inst. C.E., obtained by means of the calorimeter an evaporative efficiency of 14·4 lb. from and at 212 F. with Welsh coal; and Mr. J. Vaughan Stewart, with another sample of Welsh coal, obtained an efficiency of 14·325 lb. These values are so close that they may be taken as average values for Welsh coals. Then if the 15·52 lb. given above as the average theoretical value for Welsh coals be reduced to 14·4 lb., the highest value obtained by the calorimeter and the other efficiencies be reduced in a like ratio, we will get the following averages: Welsh coal, 14·4 lb.; Newcastle (Eng.) coal, 14·214 lb.; Lancashire coal, 13·516 lb.; Scotch coal, 13·6 lb. Returning now to Queensland coals: The calorimeter tests made in Brisbane give the following values:—The West Moreton coals, forming the first group, show an efficiency equal to 13·997 lb. of water evaporated from and at 212 F. for each lb. of fuel consumed; the West Moreton coals forming the second group have not been all tested in the calorimeter. The Burrum coals gave 14·18 lb.; the Darling Downs coal, 13·111 lb.; the New South Wales, from the north of Sydney, gave 13·537 lb.; the New South Wales, from the south of Sydney, 13·535 lb. Supposing an ordinary steam boiler to have a co-efficient of efficiency equal to 0·6, the following table will then show the values of the coals for working purpose, and to show how the calorimeter tests agree with the actual boiler tests, the two are here given:—

Name of Coal.	Reduced Theoretical Value.	Calorimeter Tests, x.6.	Other Tests.
	Lb.	Lb.	Lb.
Welsh	8·64		
Newcastle (England)	8·528		
Lancashire	8·109		
Scotch	8·160		
West Moreton, 1st Group	...	8·397	7·96
West Moreton, 2nd Group	...	...	7·10
Burrum	...	8·508	8·07
Darling Downs	...	7·866	8·04
New South Wales, Northern District	...	8·122	8·153
New South Wales, Southern District	...	8·145	8·043

Some time ago various samples of Queensland coals were tested in a 16-h.p. boiler in Brisbane, when the results from the first group of West Moreton coals showed an evaporative power equal to 8·271 lb. of water from and at 212 F. Grouping the above values together, we have the average evaporative power of the home coal equal to 8·359 lb. of water ; Queensland coals, calorimeter tests, 8·291 lb.; Queensland coals, "Otter" tests (leaving out the West Moreton second group), 8·023 lb.; New South Wales coal, calorimeter tests, 8·1335 lb.; New South Wales coals, "Otter" tests, 8·058 lb. From the above returns it will be seen that the better class coals from the Queensland Mines have a high economic value as steam coals, and as before stated, are very well able to hold their own with any other coal at present found in Australia. There is one matter in connection with our coals that now demands our attention—that is the matter of the large percentage of impurities mixed with most of them. No doubt some of these impurities are so intimately mixed with the fuel that it would be a difficult matter to separate the two, but in considering this part of our subject we have to differentiate between impurities that are chemically combined with the coals and other that are only mechanically mixed. The former must perforce be left alone ; most of the latter, however, can and should be dealt with. Most of the impurities in the Queensland coals appear to be clay bands and sand. The only method at present in use to get rid of these foreign matters is to screen the coal at the pit head. Screening is all very well in its way ; still, it is only a rough and ready method of getting rid of the part of the small coal and dirt. In some cases it was to be feared the screenings had not been so perfect as it might be, the consequence being that the coals had been sent away to market with a greater amount of unburnable stuff mixed among them than should have been the case, and so they have given our coals in many quarters a bad name. With coals, as with any other commodity, it is a case of give a dog a bad name it will stick to it. Now, unless our colliery proprietors themselves try something to get this bad name removed, it has every chance of remaining, The first thing to be done in this direction is to clean their coals that the proportion of unburnable stuff can be brought down to reasonable dimensions. They should make it their aim to put the coal on the market in the cleanest possible manner. By doing so they may not be able to reap any immediate benefit, but, assuredly, they would be handsomely repaid in the long run. A coal to make headway in a new market must be better or cleaner than the coals that have held that market previously. So that it is an absolutely plain fact to anyone who has given the matter a thought, that unless the coals of this colony are put on the market more free from dirt than they are at the present time, they will never command the position that is theirs by right. In France, Germany, America, and in Great Britain the washing of coal is at the present time receiving a considerable amount of attention. As an instance of what may be done by means of an efficient system of washing, mention may be made of a coal-washing machine (a German patent) that Messrs. Merry and Cunninghame, the coal masters in the west of Scotland, have had fitted up for dealing with the coals at one of their pits. This machine stands about 60 feet high, the coals being hoisted right up to the top. It then gravitates through the different stages until it finally falls into the wagons placed under the different shoots. Before the machine was erected the coal was screened in the usual manner, and two or three sorts of coal sent to the market. Now the coal is so carefully graded that they can send no less than six different sorts to the market. The cost of the machine was something like £10,000, and the cost of washing comes to about ¾d. per ton. It cannot for a moment be imagined that our coal owners are in a position to initiate a process of such magnitude as that mentioned above. Still something might be done with the view of testing whether our coals would stand an efficient system of washing or no. The Queensland coals all being more or less friable, the amount of small coal that goes through the screens with the dirt is very large. As matters are now there is practically no outlet, for this slack, &c., if we except that which our local gas companies use for gas-making purposes. Now, if this slack can be profitably used in that manner, it is surely also good for other purposes. There are three ways in which slack may be of use—first, by constructing boilers with special furnaces suitable for burning it ; second, by making patent fuel from it ; and third, by making coke. The first may be dismissed as impractical at the present time, and with regard to the second mode of disposing of it, it may be remembered that a well-known colliery proprietor in the West Moreton District some years ago had machinery erected to make patent fuel, but after working for some time the industry had to be given up as a local market could not be found for it. A large proportion of the patent fuel made in Wales and England is exported, people at home, where coal is cheap, will not use patent fuel. The same reason here operated against the sale of patent fuel, hence the failure of the enterprise. Locally, our coals are too cheap, and if the patent fuel industry is to be a success here it must be by getting a market across the sea. The third way—viz., making coke, has been to a certain extent successful, but the coke-making industry is capable of very great expansion. Many of our bituminous coals have a large percentage of fixed carbon, and are suitable in many ways for the production of first-class coke. Yet the coke trade for the principal market in the colonies—viz., Broken Hill, is practically the monopoly of the Durham coke-makers. Coke made from Queensland coal, having to be carried only an eighth part of the distance that English coke has to be carried, should surely stand a very good chance of securing all the colonial markets. The very small amount of sulphur in most of our coals gives them an additional advantage in this respect. In the early part of this paper it was stated that the work had not been made to suit the coal, but, on the contrary, the aim of the experiment had been to determine the value of the coal when made to fit the work. The question may then be asked : Are the furnaces that we now use or are the boiler proportions the best that can be desired for the purpose of economically burning coals ? Well, it is pretty safe to say that they are capable of improvement. The writer's own idea is, that so far as marine boilers are concerned, the coals would give better results with narrow firebars, having narrow air spaces between, the air space in the aggregate, however, to be greater than it is at present, also to have large combustion chambers, care being taken to arrange for a proper supply of atmospheric air being admitted to them to allow of the gases having the proper supply of oxygen necessary to complete combustion. It would also be a good thing to increase the tube area, as the large amount of soot given off by bituminous coals in the ordinary way of burning very soon fills up the bottom rows of the tubes ; it is an improvement to divide the smoke box into separate divisions, *i.e.*, have a separate smoke box for each furnace. Other alterations and improvements will do doubt suggest themselves to the members. In drawing the paper to a close it must be stated that the work involved in ascertaining the powers of our coals from a steam user's point of view has been a work of absorbing interest, and one which at some future time could be carried out in a far more complete form than has been done in the present instance, and with even better results to the coals under review. No notice has been taken of the great extent of our coal resources, that being a matter that may safely be left in the hands of our geologists, who tell us that coal extends in an almost unbroken line from near Cape York to the southern border of the colony. In conclusion, our thanks are due to the Honourable the Colonial Secretary, Mr. Horace Tozer, for giving a very ready assent to the trials being carried out, and also for giving instructions for the original trails to be so extended that they have embraced all the different coals that have been mentioned in this paper. Our thanks are also due to Mr. J. Vaughan Stewart, Acting Chief Engineer for the Department of Harbours and Rivers, for his ready assistance in supplying dates, and for the use of the machine that is now standing before you. Mention must also be made of Mr. R. L. Jack, Government Geologist, who in the kindest manner placed all the departmental reports on our coalfields at the writer's disposal.

ADDENDA.

I.—SHAFT JOURNALS OF ABERDARE, WEST MORETON, AND BOREHOLE COLLIERIES.

(A, B, and C, from Annual Report of Andrew Gibb Maitland, Assistant Geologist, for the year 1895 ; D from Office Records.)

A.—Section of Strata in Coolgardie Shaft, Portion 159, Parish of Ipswich.

—	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Surface débris and basalt	100	0	100	0
Soft shale	40	0	140	0
Black shale	45	0	185	0
Sandstone	20	0	205	0
Conglomerate	20	0	225	0
Sandstone and shale	No data.		...	
Coal (Aberdare Seam) with thin bands	7	6	520	0

B.—Section of Strata in Borehole Shaft, Portion 174, Parish of Goodna.

	Depth.	
	Ft.	in.
Strata—*Coal*, Aberdare Seam	104	0
Strata—*Coal*, Dirty Seam	224	0
Strata (sandstone and shale)—*Coal*, Four-foot-six Seam	520	0

C.—Section of Strata in the West Moreton Old Shaft, Portion 180, Parish of Ipswich.

—	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Strata	...		160	0
Coal	2	0	162	0
Strata	...		...	
Coal (Thomas's Aberdare Seam)	...		631	0
Dark shale	14	3	645	3
Sandstone with bands of shale ranging from 4 inches to 8 inches thick	30	0	675	3
Grey sandy shale with bands of hard sandstone 6 inches thick	8	0	683	3
Dark shale	10	0	693	3
Coal	1	8	694	11
White band (? fireclay)	0	4	695	3
Coal	0	9	696	0
Very sandy shale	12	0	708	0
Fireclay	1	6	709	6
Dark shale	3	6	713	0
Sandstone	2	0	715	0
Sandy shale	2	0	717	0
Grey shale with coal partings	2	0	719	0
Grey shale with hard sandstone bands from 6 inches to 8 inches	6	6	725	6
Dark shale with coal partings	5	0	730	6
Grey shale	4	0	734	6
Dark shale with coal streaks	3	0	737	6
Grey shale	2	0	739	6
Dark shale	3	6	743	0
Grey shale with sandstone bands	6	0	749	0
Dark shale	5	0	754	0
Fireclay (? clay shale)	5	6	759	6
Grey and dark shale	2	6	762	0
Grey sandy shale	3	6	765	6
Dark shale with coal partings	14	6	780	0
Grey sandy shale	6	0	786	0
Grey and dark shale	6	0	792	0
Dark shale	7	0	799	6
Dark shale with bands of sandy shale	4	6	804	0
Grey and dark shale	4	0	808	0
Sandy shale	2	0	810	0
Dark shale	4	0	814	0
Coal with bands of stone every 4 to 6 inches (Dirty Seam)	4	0	818	0
Band of coal	1	2	819	2
Dark shale with bands of coal	11	10	831	0
Sandstone with coals from 2 inches to 8 inches	4	0	835	0
Coal	1	0	836	0
Sandstone and dark shale	1	0	837	0
Coal	0	10	837	10
Band	0	2	838	0
Coal	2	0	840	0
White band	0	2	840	2
Coal	0	8	840	10
White band	0	4	841	2
Bands of coal and stone	3	0	844	2
Dark shale with white bands	8	0	852	2
Dark shale with bands of coal	12	0	864	2
Dark shale	5	0	869	2
Sandy shale	2	0	871	2
Dark shale with coal bands	3	0	874	2
Blue shale	4	6	878	8
Dark blue shale with white bands, 1 inch to 2 inches	10	0	889	8
Dark shale	11	4	901	0
Grey shale with bands of sandstone, 4 inches to 9 inches	9	0	910	0
Sandy shale	4	0	914	0
Sandstone intersected with coal	14	0	928	0

D.—SECTION OF STRATA IN WEST MORETON SHAFT, PORTION 180, PARISH OF IPSWICH, FROM SURFACE TO ABERDARE SEAM.

Description of Strata.	Thickness.		Depth.	
	Ft.	in.	Ft.	in.
Soil and Gravel	16	2	16	2
Sandstone	56	0	72	2
Sandstone and shale	4	6	76	8
Clay	0	6	77	2
Sandstone and shale	49	0	126	2
Dark sandstone with shale ...	7	0	133	2
Sandstone and shale	3	2	136	4
Sandstone	4	0	140	4
Shale and sandstone	4	0	144	4
Sandstone	5	6	149	10
Shale	1	0	150	10
Sandstone	8	0	158	10
Blackstone and shale	2	2	161	0
Coal	2	3	163	3
Shale	7	9	171	0
Sandstone and shale	15	0	186	0
Shale	7	8	193	8
Sandstone with shale	2	10	196	6
Sandstone	3	8	200	2
Sandstone and shale	4	9	204	11
Dark shale	3	5	208	4
Sandstone and shale	0	5	208	9
Grey shale	8	2	216	11
Sandstone	7	0	223	11
Shale (jointy)	21	8	245	7
Coal and dirt	0	9	246	4
Shale	3	8	250	0
Coal and dirt	2	8	252	8
Dark shale	18	0	270	8
Sandstone and dark shale ...	4	0	274	8
Shale and sandstone	4	1	278	9
Dark shale	11	3	290	0
Shale and sandstone	7	3	297	3
Ironstone band	1	6	298	9
Dark blue shale	10	9	309	6
Sandstone and shale	2	1	311	7
Dark shale	1	11	313	6
Grey shale	1	5	314	11
Sandstone	6	4	321	3
Dark shale	9	3	330	6
Shale with coal streaks... ...	1	1	331	7
Coal (stony)	2	6	334	1
Sandstone	3	0	337	1
Shale	5	8	342	9
Conglomerate	1	1	343	10
Coal	0	4	344	2
Shale and sandstone mixed with coal	22	4	366	6
Fine conglomerate	2	11	369	5
Black shale	6	0	375	5
Sandstone and shale	3	8	379	1
Conglomerate	2	1	381	2
Dark shale	0	10	382	0
Conglomerate	1	8	383	8
Light shale	17	6	401	2
Coaly shale	3	3	404	5
Conglomerate	1	0	405	5
Coaly shale	2	6	407	11
Sandstone	2	6	410	5
Light shale	22	0	432	5
Sandstone	1	0	433	5
Conglomerate	8	3	441	8
Light shale	1	6	443	2
Conglomerate	36	0	479	2
Shale and sandstone	11	0	490	2
Soft sandstone with coal pipes	12	0	502	2
Blue shale with streaks of sandstone	51	6	553	8
Dark shale and coal, with bands of metalliferous stones or boulders	17	0	570	8
Shale and sandstones with irregular bands of ironstone ...	14	4	612	0
Coal (Thomas's Aberdare Seam)	19	0	631	0
Stone with streaks of coal ...	2	6	633	6
Sandstone and shale	12	6	646	0

II.—TABLE SHEWING OUTPUT OF COAL FROM THE IPSWICH COAL FIELD FROM 1860 TO 1898.

(*See Mineral Wealth of Queensland, R. L. J.*, 1898; *Geological Survey Publication No.* 48; *and, Annual Reports Department of Mines.*)

Year.	Quantity.	Value.
	Tons.	£
1860-1882	814,407	414,368
1883	98,310	49,114
1884	114,577	56,475
1885	180,744	71,258
1886	189,608	72,054
1887	193,286	71,851
1888	254,778	97,851
1889	217,240	95,202
1890	276,063	120,476
1891	222,766	97,757
1892	215,535	91,798
1893	202,429	86,582
1894	207,672	81,201
1895	239,712	89,150
1896	280,094	106,740
1897	277,172	97,411
1898	310,444	103,927
Total ...	4,294,837	1,803,215

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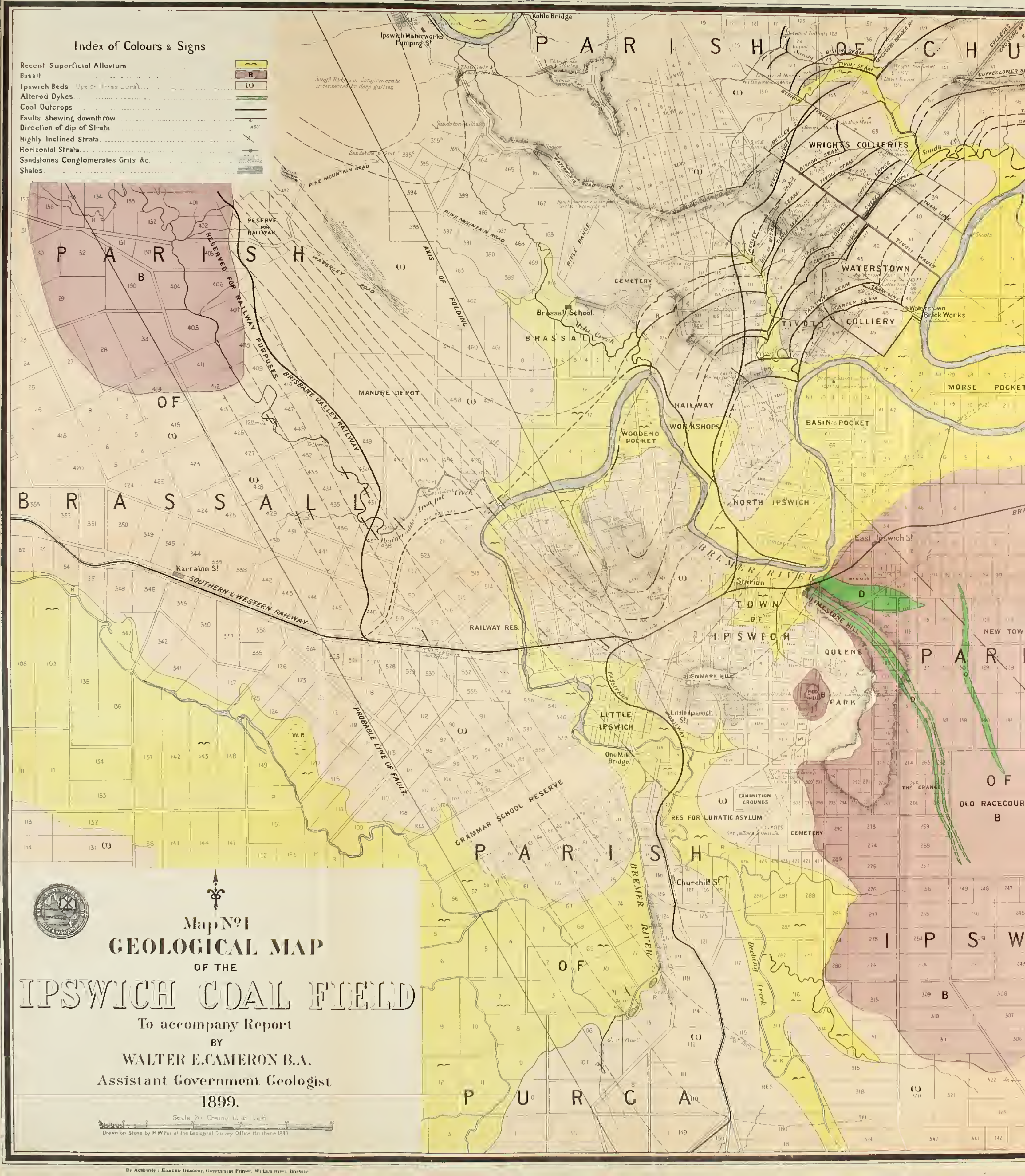

Map No 1

GEOLOGICAL MAP

OF THE

IPSWICH COAL FIELD

To accompany Report

BY

WALTER E. CAMERON B.A.

Assistant Government Geologist

1899.

Scale 20 Chains to an Inch

Drawn on Stone by H W Fox at the Geological Survey Office Brisbane 1899

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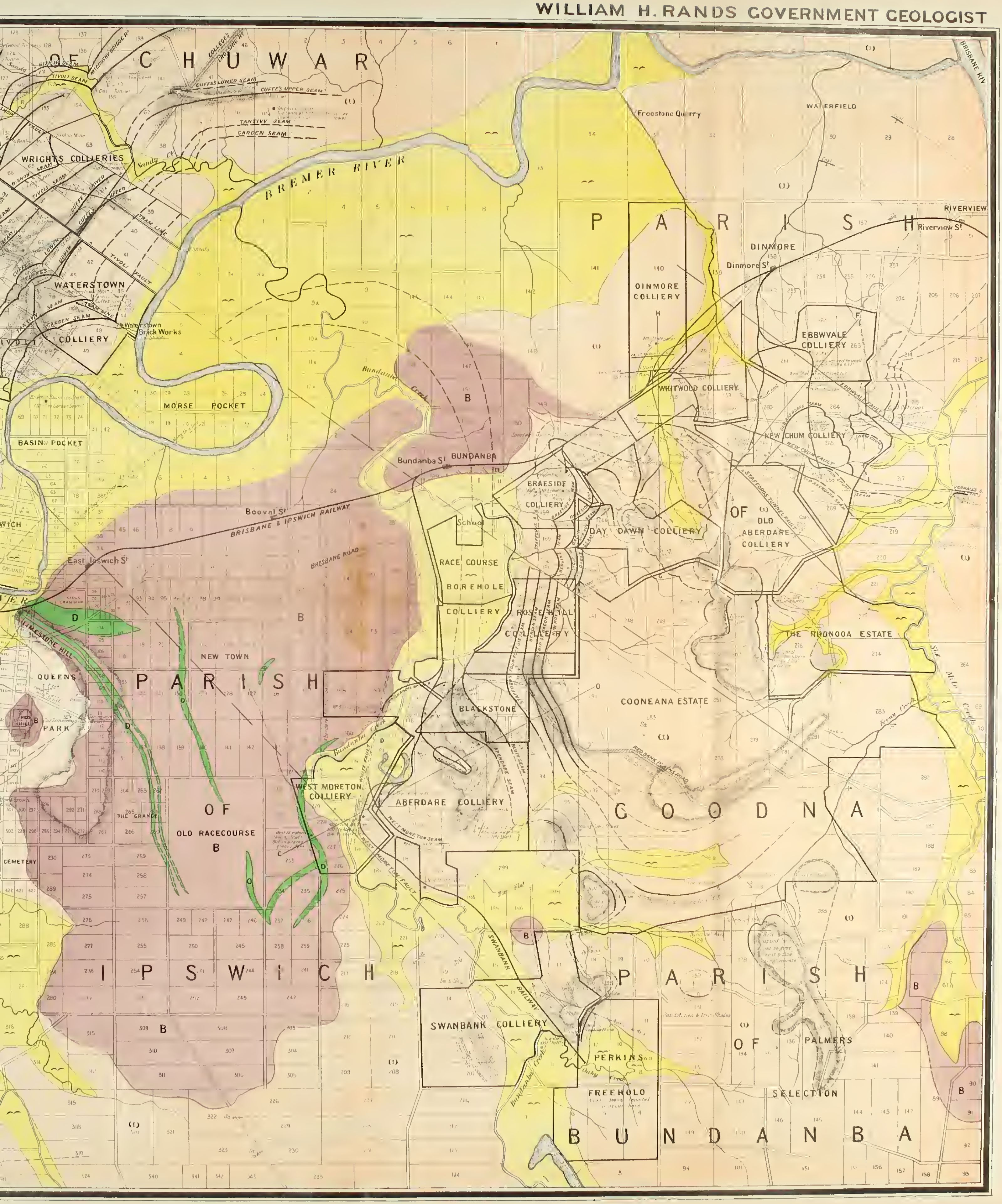

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GEOLOGICAL SURVEY of QUEENSLAND

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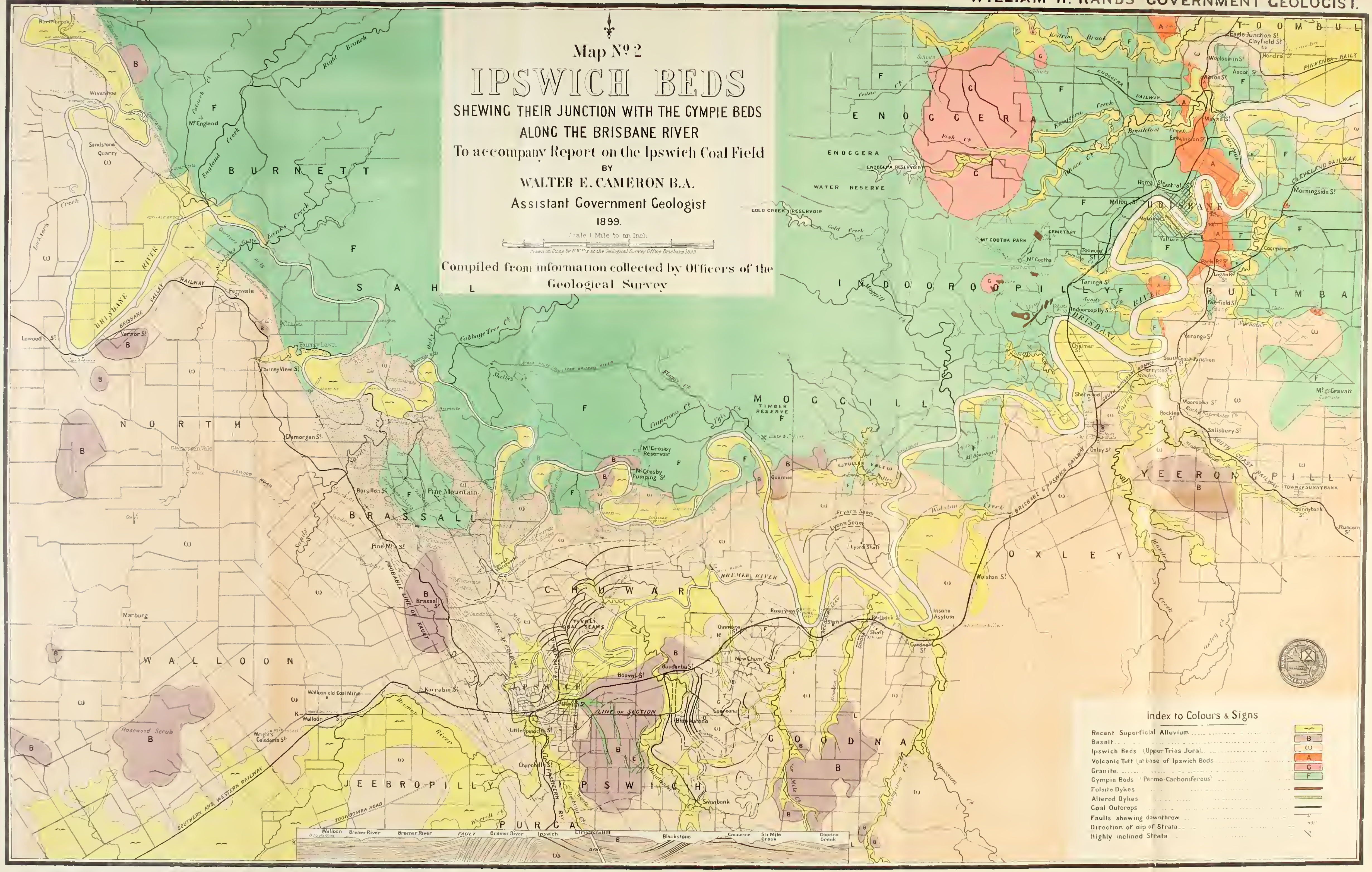

Map Nº 2

IPSWICH BEDS

SHEWING THEIR JUNCTION WITH THE GYMPIE BEDS ALONG THE BRISBANE RIVER

To accompany Report on the Ipswich Coal Field

BY

WALTER E. CAMERON B.A.

Assistant Government Geologist

1899.

Scale 1 Mile to an Inch

Drawn on Stone by H.W. Fox at the Geological Survey Office Brisbane 1899

Compiled from information collected by Officers of the Geological Survey

Index to Colours & Signs

Recent Superficial Alluvium	⁀
Basalt	B
Ipswich Beds (Upper Trias Jura)	ω
Volcanic Tuff (at base of Ipswich Beds	A
Granite	G
Gympie Beds (Permo-Carboniferous)	F
Felsite Dykes	▬
Altered Dykes	▬
Coal Outcrops	▬
Faults shewing downthrow	┬
Direction of dip of Strata	→
Highly inclined Strata	╲

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1900.

QUEENSLAND.

THE PERMO-CARBONIFEROUS COAL MEASURES OF CLERMONT AND ASSOCIATED FORMATIONS.

(REPORT ON, BY B. DUNSTAN, F.G.S., ASSISTANT GOVERNMENT GEOLOGIST.)

[*With* 1 *Map*, 6 *Plates, and* 7 *Figures.*]

Presented to both Houses of Parliament by Command.

LETTER OF TRANSMITTAL.

TO THE HONOURABLE THE SECRETARY FOR MINES.

Geological Survey Office,
Brisbane, 21st April, 1900.

Sir,—I have the honour to forward herewith a report on the Permo-Carboniferous Coal Measures of Clermont, and Associated Formations, with a Map and Plates.

I have, &c.,
WILLIAM H. RANDS,
Government Geologist.

CONTENTS.

PAGE.
Introduction ... 2
  Physical Features ... 2
Previous Reports, &c., on the Clermont District ... 2
Geological Formations—
  Granite ... 2
  Slates and Schists with Quartz Reefs ... 3
  Intrusive Rocks ... 3
  Fossiliferous Limestone ... 3
  Marine Beds ... 3
  Coal Measures ... 4
  Quartzites ("Billy") ... 5
  Tertiary Basalt Flows ... 6
  Magnesian Limestone ... 7
  Tertiary and Recent Alluvial Deposits ... 7
Table of Geological Formations at Clermont ... 8
The Blair Athol Coalfield—
  Probable Area of the Coalfield ... 8
  Variations in the level of the Coal Seams ... 9
  Returns of Coal Output—quantity and value ... 10
  Coal available in the future—quantity and quality ... 10
  General Remarks ... 11
Table of Analyses of Clermont and Other Queensland Coals ... 12
The Collieries and Prospecting Shafts—
  Blair Athol Colliery ... 13
  Imbell Colliery ... 13
  Eldorado Colliery ... 14
  Hope Colliery ... 14
  The Newcastle Shafts ... 15
  Bastet's Shaft ... 16
  Mercer's Shaft ... 16
  Other Localities ... 16
Sites for Future Prospecting Operations for Coal ... 16
Gold Deposits in the Coal Measures ... 17
Note on the Examination of Gold Deposits ... 17
Petrological Notes on the Dolerites of Wild Cat and The Springs ... 18
Table of Altitudes ... 18

LIST OF ILLUSTRATIONS.

MAP.

Geological Map of Clermont—Showing Blair Athol Coal-Measures.

PLATES.

PAGE.
Plate 1.—Geological Sections, Clermont ... Facing Page 4
  (*a*) Section across Capella street and Quarry Hill (*c* to *f*).
  (*b*) Section connecting Quarry Hill Shaft and Enterprise Shaft (*g* to *h*).
Plate 2.—Clermont Coal-shaft Sections ... „ 8
Plate 3.—Plan of Underground Workings, Imbell Colliery ... „ 12
Plate 4.—Plan of Underground Workings, Eldorado Colliery ... „ 14
Plate 5.—Plan of Underground Workings, Hope Colliery ... „ 16
Plate 6.—Geological Plan of Coalmining Leases at Blair Athol, Clermont ... „ 18

FIGURES.

Figure 1.—Section at Black Ridge—
  A band of coal above an auriferous "wash." ... 5
Figure 2.—Section at Apsley Creek—
  An outcrop of "billy" surrounded by a basalt flow ... 5
Figure 3.—Section at the Springs—
  An old channel in the "All Nations" lead containing dolerite (basalt) and boulders of "billy" ... 6
Figure 4.—Section at Wild Cat Lead—
  Showing auriferous deposits above and below basalt ... 7
Figure 5.—Fault at Imbell Colliery—
  Dislocating the coal seam by an upward thrust ... 14
Figure 6.—Section at Newcastle Mine—
  Showing the contact of coal and slate ... 15
Figure 7.—Section at Hurley's Diggings—
  A coal band probably covering an auriferous "lead" ... 17

INTRODUCTION.

The field work connected with this Report on the Geology of Clermont and the Blair Athol Coal Field was started on the 27th September, and, except for a week engaged on other work, was continued up till the 1st November, 1889, when the work was completed.

Clermont is the present terminus of a northern branch of the Central Railway Line whose junction is at Emerald. From this junction to Clermont by the railway line the distance is sixty-two miles, and from Rockhampton 228 miles.

A railway to connect Clermont with one of the towns on the Northern Railway Line has been suggested, and three preliminary traverses have been made to connect Clermont with three different places on that line.

The Locality Plan attached to the accompanying Geological Map will show the position of Clermont with regard to the Northern Railway at Charters Towers, Ravenswood, and Townsville, and to the Central Line at Emerald and Rockhampton.

Physical Features.

The main watershed of the district examined is the Drummond Range, which has a north-easterly extension at a distance of about twenty miles to the west and about twelve miles to the north of Clermont. From the range, in both directions, the country very gradually falls away towards Clermont. Some of the ridges and spurs between the range and Clermont are rugged and conspicuous, but, generally, the country is of a monotonous character.

Gowrie and Ti-tree Creeks drain this area in the extreme north and north-east, while Apsley Creek drains the centre—all three creeks running into Wolfang Creek on the east side. Wolfang Creek junctions with Sandy Creek at Clermont. On the west side Yankee Creek, heading in the north, joins Green's Gully from the west, both coming together at the Washpool at the south end of the coalfield. Bathampton Creek heads in the coalfield and runs south-west to the Washpool; then south to the Venus to join Hurley's Creek coming from the west; then trends south-east and joins Oaky Creek heading from the west and south-west, which together form Sandy Creek.

The country near the Drummond Range to the north is partly basaltic; to the east and north-east it is all basaltic; but in all other directions the creeks drain country more or less auriferous, and all the creeks are concentrated in Sandy Creek at Clermont, where a large amount of sandy alluvium has accumulated to form large flat areas.

PREVIOUS REPORTS ON THE CLERMONT DISTRICT.

R. Daintree.—"Notes on the Geology of Queensland," published in the Quart. Journ. Geol. Soc. Lond., 1872, Vol. XXVIII., p. 285. In this the Coal Measures of the district are referred to in general terms.

W. H. Rands.—"Report on the Geology and Mineral Deposits of the country in the vicinity of Clermont." 1886. This report and accompanying Map was the basis on which the recent work was carried out. It is since this report was written that the Blair Athol Coal Field has been developed.

Jack and Etheridge.—"Geology and Palæontology of Queensland and New Guinea." 1892. Numerous references are made in this work to Clermont.

R. L. Jack.—"Progress Report for the year 1894." In this an account is given of a visit to Clermont and The Springs.

A. Gibb Maitland.—"Proposed Boring for Coal on the Central Railway." 1895. In this report Capella and the granite masses there are referred to, and also a note of the various sedimentary beds in Portion 18v., parish of Capella.

R. L. Jack.—"Progress Report for the year 1896." The notes on Clermont deal more particularly with the Quarry Hill Shaft, and the probability of finding gold there. There is also some information concerning the alluvial workings in the district.

Reference will be made in the following pages to these reports where necessary.

GEOLOGICAL FORMATIONS.

Granite.

Although granite does not occur close to Clermont, it is exposed away towards the south-east near Capella about half-way between Emerald and Clermont, and is associated there with the same class of rocks (schists and slates) which occurs at Clermont. Mr. Maitland states that "the heads of the creek to the west of the township of Capella show these beds resting directly upon granite, which, where not covered by basalt, occupies a considerable area of country. The granite is exposed in Little Abor Creek at 199½ miles, where it is crossed by the railway, but does not extend many yards to the north"*, and also according to Mr. Jack,† at about twelve miles to the south of Clermont, between Douglas Creek and Policeman Creek.

From the presence of the granite boulders and pebbles which are found in the beds of the Quarry Hill Shaft, however, it seems probable that the configuration of the country at that time was different to what it is at present. The boulders were probably brought by streams from the vicinity of Policeman Creek to the position in which they are now found.

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* Report on Proposed Boring for Coal on the Central Railway. A.G.M. By Authority: Brisbane, 1895.

† Progress Report for the year 1894, p. 10. By Authority: Brisbane, 1895.

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SLATES AND SCHISTS WITH QUARTZ REEFS.

Slates and schists surround the Coal Measures on all sides. The town of Clermont is partly situated on chloritic and talcose slates, and the country to the west, north-west, and south-west for several miles is mostly slates and schists of various kinds. On the Drummond Range to the north and north-east the slates are exposed in places above the level of a great flow of basalt. (See accompanying plan.) At the Blair Athol Coal Field in the Newcastle air-shaft the seam of coal rests on the inclined surface of slates, an illustration of which is shown in Fig. 6, page 15.

There is considerable diversity in the mineral composition of the slates as they are in places talcose, micaceous, chloritic, hornblendic, siliceous, or clayey.

Near the watercourses, particularly in Sandy Creek, they have suffered very little weathering, but on the hills and ridges they are so much decomposed that it is difficult to say whether they are very old deposits, or recently formed deposits from the débris of the old ones.

Their age has not been determined, palæontologically or stratigraphically, as no evidence has been forthcoming, so far, to indicate what position they should be assigned to, further than that at Douglas Creek a bed of fossiliferous limestone occurs close to the slates and schists there, whose relation, however, to the slates have not been established.

Mr. Daintree refers the slates to the "Lower Silurian Series, or even to the still older metamorphic system of Victoria."*

The agency which altered the mineral composition, although perhaps not the chemical composition of the old sedimentary rocks, also produced changes in their geological position, and in consequence small fissures have been made and subsequently filled with quartz to form quartz reefs and veins.

The occurrence of the reefs here is a matter of importance as some have proved very rich in gold; but attention was not paid to them. They have been referred to by Mr. Rands and Mr. Jack.†

The denudation of these reefs and veins have been going on from a time prior to the formation of the coal deposits, and the gold shed from them has been accumulated in the old channels at Hurley, The Springs, Wild Cat, &c., of the Coal Measure Period, and in the present innumerable watercourses which at the present time lead into Sandy Creek at Clermont.

INTRUSIVE ROCKS.

It is generally supposed that there is a total absence of intrusive igneous rocks in the Clermont district; but during the recent examination a shaft was inspected near Douglas Creek—put down by the Clermont Prospecting Association—which had penetrated a decomposed felspathic dyke, and was abandoned on coming to a rock which, from the microscopic examination of a section, seemed to be partly decomposed diabase.

FOSSILIFEROUS LIMESTONE.

During Mr. Rands's examination of the Clermont district in 1886, he observed that "a bed of dark-coloured crystalline limestone crops out close to Douglas Creek, about three miles below its junction with Drummond Creek, and about four miles south-east of Copperfield."‡

The limestone is exposed on Bettridge's Selection No. 35, near Douglas Creek, and takes a north-north-east and south-south-westerly direction. It is continued on the opposite side of Douglas Creek, on Selection No. 75, where it is fossiliferous. The limestone is quarried on Selection No. 35 for lime-making, and is said to be quite equal to that of Rockhampton for this purpose.

In some places the limestone is undoubtedly crystalline, and small calcite veins can be noticed in it; but where the limestone is quarried it is non-crystalline, is very free from silica, and does not appear to have suffered much alteration in structure.

In the bed of the creek and on one side of the line of outcrop of the limestone a felspar porphyry is exposed. Schists occur near the porphyry on and around which the limestones have probably been deposited. Close to and above the level of the limestone occurs a bed of quartzite. The quartzites are traversed by veins of white quartz, and the limestone to some extent is silicified. Further than this no information regarding their relationship could be obtained on account of the rocks being hidden by more recent deposits.

It is said other outcrops also occur two miles to the south-east and also one mile to the north-east of the Douglas Creek outcrop, but they were not examined to determine what connection they have with the latter.§

The fossils found by Mr. Rands, and during the recent visit, are species of *Favosites*, *Cyathophyllum*, *Stromotopora*, *Syringopora*, *Pachypora*, *Pentamerus*, *Atypa*, and fragments of *Gastropods*.‖

THE MARINE BEDS.

After the formation of the limestone of Douglas Creek, which probably are Devonian, there is nothing to indicate the presence of any other succeeding formation until we come to a marine series of rocks belonging to one of the "Bowen" Formations.

On the northern side of the Drummond Range, and to the south of Clermont at Capella, and also at the bottom of the Quarry Hill Shaft, marine shells have been found, and each of these localities are probably on the same geological horizon. From a general aspect it seems quite probable the marine beds extend and dip northerly from Capella where they are found on the surface, to Clermont where they occur about 450 feet below the surface. From Clermont they might be continued under the Freshwater Beds and basalt towards and under The Springs, where they would thin out, and then to make and rise again to the surface further north of the Drummond Range.

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* Quart. Journ. Geol. Soc. Lond., Vol. xxviii., p. 301.

† (1) Report on the Geology and Mineral Resources of the country in the vicinity of Clermont. W.H.R. By Authority: Brisbane, 1886, pp. 4-7.

(2) Progress Report for the year 1894. R.L.J. By Authority: Brisbane, 1895, p. 14.

‡ *Ibid.*, page 4.—Copperfield is situated about four miles south-south-west of Clermont.

§ The position of these limestones is below the area covered by the accompanying Geological Map, but they are shown on the map accompanying Mr. Rands's "Report on the Geology and Mineral Deposits of the country in the vicinity of Clermont."

‖ Unfortunately, a beautiful collection of these fossils, obtained by the writer, together with others from the Quarry Hill Shaft, have been lost recently in transit from Clermont.

The beds containing the fossils have been provisionally classed as "Middle Bowen," although they might be interbedded with the Freshwater Series recognised as the Upper Bowen Formation.

The Sections on Plate 1 show the relation of the Marine Beds to the slates on which they rest, and also to their supposed relation to the Freshwater Beds above them.

The altitude of the Marine Beds at the bottom of the Quarry Hill Shaft is a little over 500 feet above sea level. If their position has not been altered they would be found at a depth of about 400 feet below the coal seam at present worked at Blair Athol, and at about the same depth at The Springs.

From the Section (*a*) between Quarry Hill Shaft and Clermont shown on Plate 1, and from the general trend of the slates between Clermont and The Springs (seen on the accompanying Geological Map), very probably an old coast line existed connecting these two places. On the eastern side material accumulated to form marine deposits, while the old palæozoic rocks on the western side remained dry land.

Further accumulations resulted in this marine area being filled up and transformed into freshwater deposits, where only the remains of plant life were preserved.

Apparently no break occurs during the change from marine to freshwater conditions, and although in the present report the two formations are separated—one to be called the Middle Bowen (marine) and the other Upper Bowen (freshwater)—yet it is a question for future consideration whether it would not be better to place them as divisions of the same formation.

During the recent work the following fossils collected from the Quarry Hill Shaft have been recognised:—

Edmondia sp.
Fenestella sp.
Dielasma saccula (Martin) *var.*
Mourlonia sp.
Connularia inornata (Dana)
Martiniopsis subradiata (Sow.)
Productus brachythærus (Sow.)
Spirifera sp.
Stenopora sp.
Astartella sp.
Aviculopecten multiradiatus (Eth.)

THE COAL MEASURES.

LOCALITIES.—The main exposed area of the Coal Measures is around Blair Athol, but they are also found in many other places (see accompanying Geological Map). At Clermont the Measures have been penetrated in the Quarry Hill Shaft, in the Enterprise Shaft a little over half-a-mile south-east of the Quarry Shaft on the opposite side of the railway line (sections of which are shown on Plate 1), at the Wild Cat Lead, and at McDonald's Flat. At these two latter places old channels have been cut in the slates, and have joined together to the south-east of Clermont. It is unknown how much further to the east of Clermont than Quarry Hill the Coal Measures extend, as basalt covers the country for miles in that direction. At Mount Oscar, however, north-east of Clermont, the slates are exposed above the basalt, so the Coal Measures must be in width less than this distance, which is about twelve miles.

At The Springs to the north-north-east of Clermont, in the beds met with in sinking prospecting shafts for alluvial gold, Mr. Rands obtained several specimens of the characteristic Permo-Carboniferous fern *Glossopteris.**

In one of the watercourses at Hurley's Diggings a shaft was sunk to test the deposits below for gold, but was abandoned when a band of coal was encountered. Probably it was from Hurley's Diggings the Blair Athol area received most of the sediment which now forms the Coal Measures. This formation, as shown on the accompanying Map, can be traced from Hurley's to Blair Athol, with the older formation of slates and schists on either side.

ROCKS.—The rocks comprising the Coal Measures include sandstones of various grades, and carbonaceous and clay shales. Generally the rocks near the surface are sandstones and very irregularly bedded, but close to the coal they become more defined.

Sometimes the sandstones bear a close resemblance to the rocks of the older formation from which they were formed. They also bear a resemblance to the more recent formations, and, on lithological evidence alone, there is some difficulty in deciding which are Coal Measures and which are not.

THICKNESS.—The total thickness of the Measures at Blair Athol are not known, but if there have been no alterations in the relative positions of the Measures here and those at the Quarry Hill Shaft, it cannot be more than 500 feet.†

COAL SEAMS.—The two coal seams already known to occur are approximately about 1,000 feet above sea level, and vary in depth to about 100 feet below the surface. The top seam, which is the one worked at present in the Hope, Imbell, Eldorado, and Blair Athol Collieries, is, on an average, about 4 feet 6 inches thick, and the unworked one about 15 feet thick, with a distance between them no greater than about 17 feet, so far as known. They do not appear to have suffered much local disturbance, although a general elevation must have taken place over the whole of the district to bring the Marine Beds at Quarry Hill Shaft and the Coal Measures with them so many feet above sea level.

DISTURBANCES AND FAULTS.—Local disturbances have produced faults in two of the collieries, and have had the effect of modifying the original plan laid down for working out the coal. One fault occurs at the Blair Athol Mine, and takes the form of a curve on the eastern side of the shaft. Bathampton Creek is just on the line of fault, and probably the position of the fault has affected the trend of the stream here. In working out the coal, the movements of the rocks in settling down after the coal has been removed have opened the fault to such an extent that the openings had to be filled with débris to allow the coal wagons to pass over.

Of the Imbell faults—for there are two of them—one is a *downthrow* or main fault of about 12 feet drop, the other is a minor *thrust* fault with an upthrow of 2 feet 6 inches. (For the direction, position, &c., of those faults see Plate 5.)

The faults have been proved for such a short distance that little information can be gleaned from their inspection. The downthrow side will show the general direction where to expect deeper ground, and this will be a future consideration when sinking to prospect for other seams which might exist below those already known.

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* *Loc. cit.*, page 3.

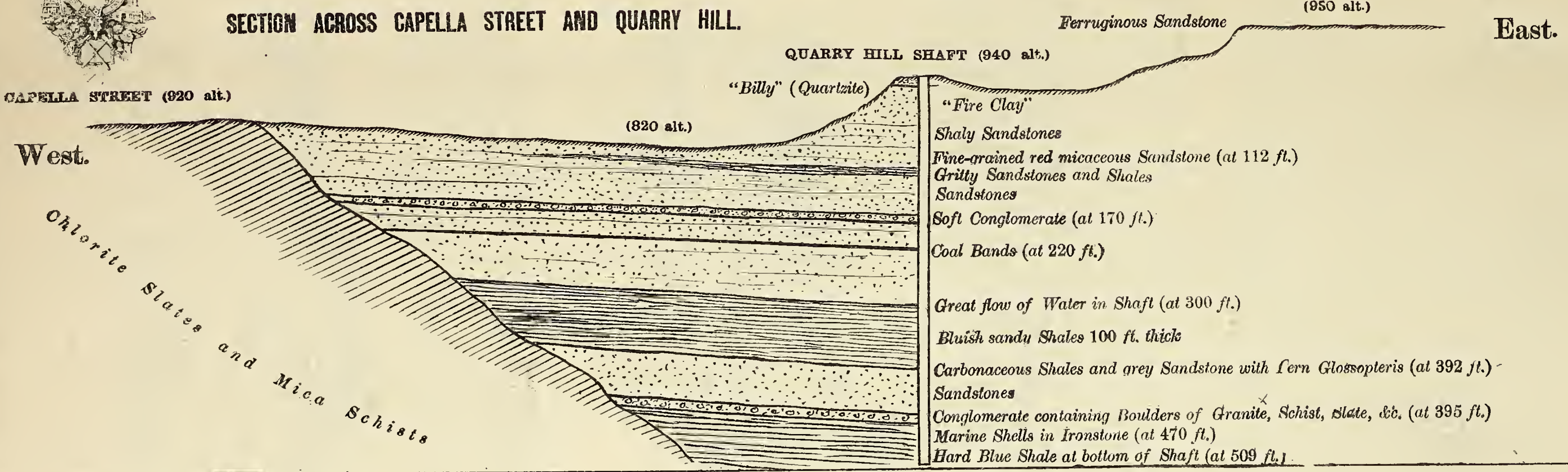
† The "Section across the Coal Measures" on the accompanying Map incorrectly represents the Measures to be much shallower than this.

A

GEOLOGICAL SECTIONS, CLERMONT.

Along Line E.F. shewn on Geological Map

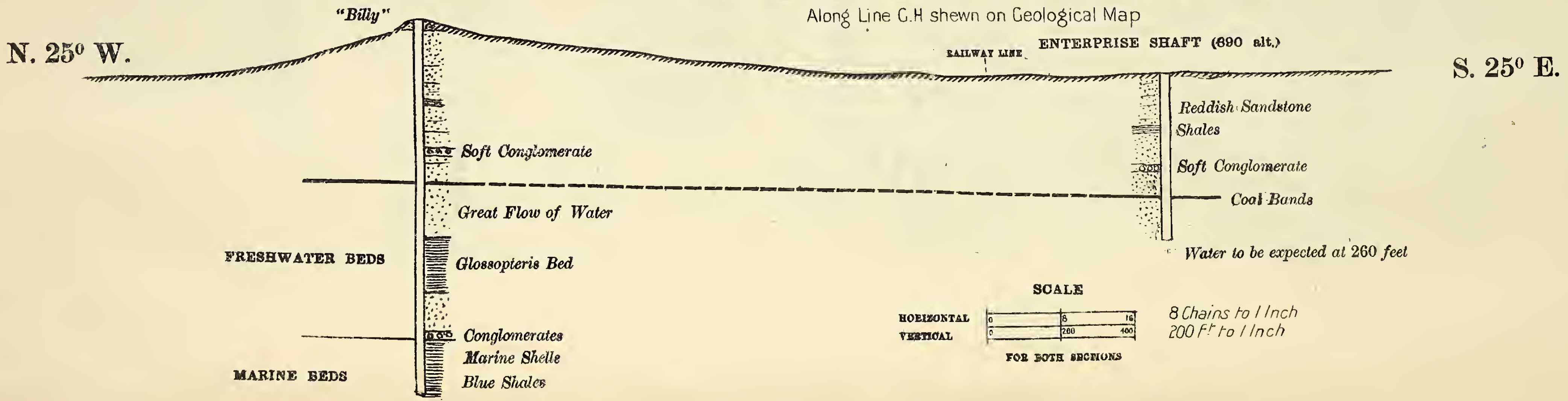
SECTION ACROSS CAPELLA STREET AND QUARRY HILL.


Ferruginous Sandstone
(950 alt.)
East.
QUARRY HILL SHAFT (940 alt.)
"Billy" (Quartzite)
CAPELLA STREET (920 alt.)
(820 alt.)
West.
Chlorite Slates and Mica Schists
"Fire Clay"
Shaly Sandstones
Fine-grained red micaceous Sandstone (at 112 ft.)
Gritty Sandstones and Shales
Sandstones
Soft Conglomerate (at 170 ft.)
Coal Bands (at 220 ft.)
Great flow of Water in Shaft (at 300 ft.)
Bluish sandy Shales 100 ft. thick
Carbonaceous Shales and grey Sandstone with Fern Glossopteris (at 392 ft.)
Sandstones
Conglomerate containing Boulders of Granite, Schist, Slate, &c. (at 395 ft.)
Marine Shells in Ironstone (at 470 ft.)
Hard Blue Shale at bottom of Shaft (at 509 ft.)

B

SECTION CONNECTING QUARRY HILL SHAFT WITH ENTERPRISE SHAFT.

Along Line G.H shewn on Geological Map



Surface Weathering.—A noticeable feature of the surface around Blair Athol is the almost total absence of denudation in the Coal Measures. Since their formation there has been very little material worn from the top of them, and this is due to their protection by basalt which once almost entirely covered them.

At Clermont the Coal Measures have been much exposed to weathering, and consequently do not preserve the same uniformity of surface as at Blair Athol.

Age.—From the presence of *Glossopteris*, the Age of the Coal Measures is at once indicated to be Palæozoic. Compared with other coalfields, the Clermont Coal Measures are the equivalent of portions of the Bowen River, Dawson River, and Mackenzie River Coal Fields, and will be considered as belonging to the Upper Bowen Formation—a division of the Permo-Carboniferous System.

They therefore are older than the Styx and Burrum Coal Fields (*Lower Trias-Jura*), and the Ipswich, Callide, and Stanwell Coal Fields (*Upper Trias-Jura*) all of Lower Mesozoic Age.

Spotted Shale and Coal.—The coal at the Newcastle Shaft, and the shale above the coal, are marked in places with spots about one-sixteenth of an inch in diameter. Mostly the spots are hollow with a fine greyish powder irregularly lining the interior, apparently the residue of some decomposed mineral substance, but sometimes the spots show a radial structure where the mineral matter has been removed.

A very similar shale is found at St. Peters, near Sydney, containing *coprolitic* remains of fishes, and it would be interesting to discover in the shale or coal at the Newcastle Shaft some of these spots undecomposed for further examination and comparison. The coprolites in the shale at St. Peters do not occupy the whole of the interior of the cast, but form a nucleus around which an incrustation of carbonate of iron is formed by the organic decomposition of the contained material. The coprolite and the incrustation is ultimately removed by further decomposition, leaving but a small residue behind.

QUARTZITES ("BILLY").

A bed of quartzite caps the Coal Measures in many places around Clermont. It is usually even-grained and semi-vitreous, with a smooth, conchoidal fracture, but occasionally it is found gritty and ferruginous. Sometimes the bed occurs as a well-defined stratum, sometimes as masses broken up into large boulders by spheroidal weathering, but commonly as small boulders and pebbles in recent alluvial deposits.

The structure and surroundings of the quartzite, or "billy," as it is locally and conveniently termed, suggests that the sandstone from which it was formed has not been altered by the general processes of metamorphism. Many places have been inspected, and special attention was given to this matter that some light might be thrown on its origin, but, so far, it has not been found (either as a bed, or as boulders or pebbles in beds) in the Coal Measures, and apparently it is of more recent age.

At The Springs and other places the "billy" occurs in the gold "leads," and at the Black Ridge it occurs on the high ground, and protects the "cement" of the Coal Measures there. The basalt of more recent age occupies the lower ground close by. (See Fig. 1.)

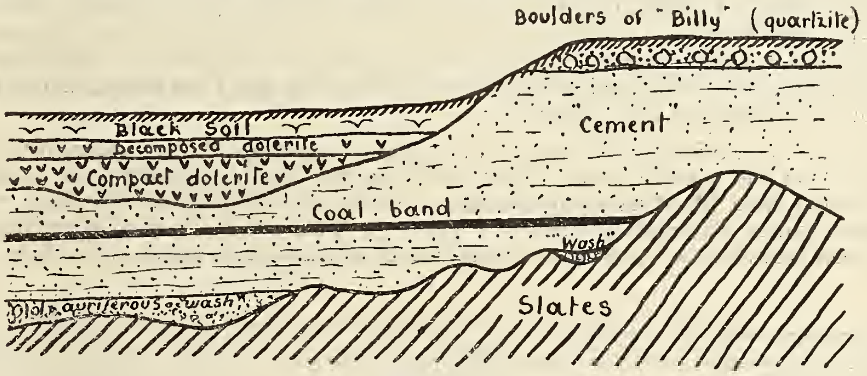


Fig. 1.
Section at Black Ridge.
A band of coal above an auriferous "wash."

Near the residence of Mr. Grant, at Apsley Creek, a black soil flat covers a flow of basalt, boulders of which are to be seen on the surface. Protruding through the basalt and black soil, and above the level of the surrounding country, occurs an isolated hill of white "billy," and its close association with the basalt suggested the change of the sandstones into a quartzite being only superficial and due to the effect of molten lava, but the present level of the plain very evidently is about the same as that of the lava when it was molten, so that the "billy" was always exposed high above it, and was never covered completely by the basalt. (See Fig. 2.)

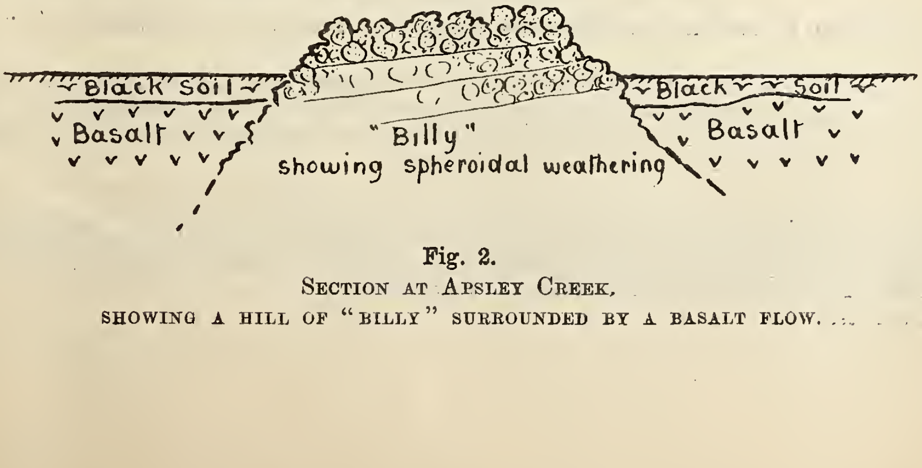


Fig. 2.
Section at Apsley Creek,
showing a hill of "billy" surrounded by a basalt flow.

At the crossing of Sandy Creek, near the cemetery, at Clermont, a bed of "billy" is exposed covering a gritty fireclay which belongs to the same series as the rocks of Quarry Hill. The bed has been somewhat disturbed as it forms an *anticline*, but basalt or other igneous rocks are not to be seen, and nothing to indicate that the change has been produced by *contact metamorphism*. The gritty fireclay below the "billy" has not been perceptibly altered, although it is in close contact with the "billy," and apparently has been subjected to the same action. In the case of the "billy," the cementing material, silica, has bound the clean grains of sand together without any clayey substance interfering, while in the case of the fireclay the particles cemented together being partly composed of clay might have become disintegrated by subsequent weathering.*

Where the "billy" is ferruginous, the silica cementing the sand grains is charged mechanically with fine particles of both red and yellow oxides of iron.

At numerous other places "billy" occurs, particularly at Quarry Hill, Wild Cat Lead, Wolfang Creek, and Blair Athol.

With regard to the age of the "billy," all the information to hand is of a negative character. It has not yielded fossils at Clermont, although similar quartzites occur in other districts which have been classed as Desert Sandstone. It is not so young as the basalt, as in several localities this rock covers not only "billy" but also beds containing boulders of it. (See Fig. 3.)

On the Dawson River, in the direction of Banana, south of the Central Railway Line, a small boulder of quartzite was found containing a number of marine fossils of Bowen or Gympie Age, but associated with other boulders which could not be distinguished from the Clermont "billy." Taking into consideration this fact and the mode of occurrence of the rock at Clermont, it is suggested that "*billy*" *has been formed by some surface action, and that this action has affected sandstones of all ages which were exposed on the surface at that time.*

If this be assumed, then the rocks which have been altered to "billy," when occurring as a defined bed, ought to be placed with the formation they are associated with, and consequently the beds at Sandy Creek and other places around Clermont should be classed as Coal Measures.

In the classification adopted in the present case, the "billy" has been placed by itself and independent of what the age of the beds which it is composed of appear to be. To classify according to the age of *alteration* instead of the age of *deposition* is perhaps an unusual method to adopt, but it will be one of present convenience.

TERTIARY BASALT FLOWS.

A flow of basalt has taken place to the north and east of Clermont on an extensive scale, but, being outside the scope of the work, no attempt was made to trace it to its source. The Drummond Range contains several prominent peaks, around which the basalt extends for miles. On the latest edition of the Geological Map of Queensland,† and also on previous editions, these peaks have been shown as volcanic peaks, but from the records of the wells sunk by Mr. Grant for the Clermont Divisional Board, and also from the wells sunk on Wolfang, it seems that in some cases at least these very sharp peaks are the outcrops of tilted beds of slate around which the basalt has flowed, and are not volcanic vents from which the basalt has been ejected.

The slope of the surface of the basalt flow is almost imperceptible but apparently inclines from north to south. On the western edge of the basalt the flow has been confined in part by the slate formation extending from The Springs to Clermont. At Blair Athol the basalt has filled or partly filled old watercourses, and at The Springs and other places the gold drifts—Permo-Carboniferous and more recent—have been overwhelmed by streams of this lava, of which sections are shown in Figs. 3 and 4.

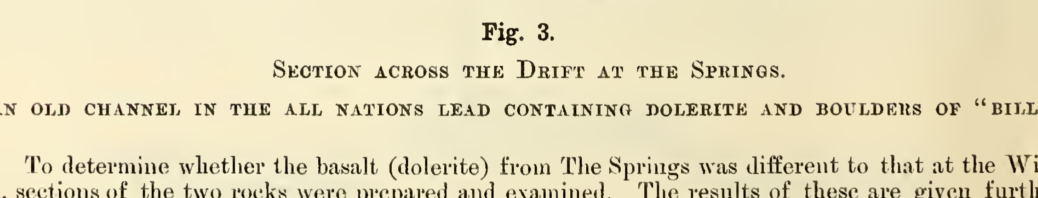

Black Soil
Wash
Wash
Wash
Auriferous Wash—ironstained
Soft decomposed dolerite
Hard compact dolerite
White Billy
Soft clayey gritty sandstone
Slates
Slates
Light-coloured "Wash" with boulders and pebbles of "Billy"

Fig. 3.

SECTION ACROSS THE DRIFT AT THE SPRINGS.

AN OLD CHANNEL IN THE ALL NATIONS LEAD CONTAINING DOLERITE AND BOULDERS OF "BILLY."

To determine whether the basalt (dolerite) from The Springs was different to that at the Wild Cat Lead, sections of the two rocks were prepared and examined. The results of these are given further on, and show so close a resemblance to one another that there is hardly any doubt but that the basalt in the two localities belong to one and the same volcanic outburst.

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[*] If sections of the quartz grains occurring in the fireclay were made and subjected to microscopic examination, some light might be thrown on the question whether a film of silica has or has not been formed around the crystalline quartz grains in the clayey matrix. If the cementing silica is present on the pebbles in the fireclay as well as in the "billy," we might assume the beds to be closely related, also that the fireclay was possibly once as compact as the "billy," but because of its complex mineral composition it has suffered decomposition from surface weathering agencies.

[†] Edition of 1899.

The suggestion that gold should be found below the spot where this dolerite occurs has been ridiculed by some, but, as the rock is identical with the dolerite at The Springs under which gold *has* been found, the idea of finding gold below the dolerite of the Wild Cat might be worth consideration.

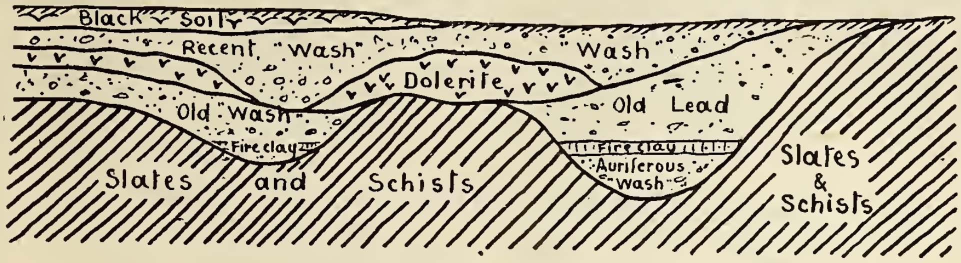

Fig. 4.

SECTION AT WILD CAT LEAD.

AN OLD BASALT (DOLERITE) ABOVE THE PERMO-CARBONIFEROUS GOLD DRIFT, AND A RECENT WASH ABOVE THE BASALT.

MAGNESIAN LIMESTONE.

In association with the black soil around Clermont, nodules and masses of limestone are to be found in several places. It occurs in some abundance on Langdon Downs to the east of Clermont, and also on the railway line near Langdon Siding about six miles from Clermont, where it has been quarried for railway ballast. About three miles to the north-east of Clermont the limestone occur as nodules on the surface of the black soil, and possibly might have some connection with that exposed on the surface at Langdon.

This limestone must not be confounded with the old Palæozoic limestone occurring at Douglas Creek and elsewhere, as it is of comparatively recent formation. It probably originated by the basalt decomposing and setting free, amongst other substances, magnesia and lime, which by atmospheric action have been formed into carbonates, and by rain carried away in solution, and which subsequently have been deposited as irregular masses.

The stone is sometimes creamy in colour, but usually a light brown, is very compact, often with a "*cone in cone*" structure, harder than an ordinary limestone, and examined in section shows no trace of crystallisation. Associated with it are chalcedony, chert, and jasper, either as nodules or as penetrating veins.

As the limestone was determined to be magnesian, a sample was taken to ascertain its suitability for making hydraulic lime. The Government Analyst conducted some experiments indicating the stone to have no hydraulic properties, and has made an analysis which shows it to have the following composition:—

MAGNESIAN LIMESTONE FROM LANGDON.

Free silica (SiO_2)	2·2
Combined silica (SiO_2)	2·9
Iron and alumina (as Fe_2O_3, Al_2O_3)	4·5
Lime (as $CaCo_3$)	52·7
Magnesia (as $MgCo_3$)	38·5

This closely approaches the theoretical composition of a normal dolomite, but in the absence of all crystallisation it would be difficult to say whether it is this mineral or a mechanical admixture of the two carbonates.

TERTIARY AND RECENT ALLUVIAL DEPOSITS.

Since the formation of "billy" no regular sedimentary deposits have accumulated, but instances are common in the Clermont District where the quartz veins, slates, and schists of the older formation, and the sandstones, shales, "billy," &c., of the younger, have become disintegrated and have formed irregular deposits.

Previous reference has been made to the auriferous deposits occurring in the Coal Measures, but the younger deposits, although sometimes difficult or even impossible to distinguish from the older ones, are usually to be indicated by the presence of boulders and pebbles of "billy," and by the absence of shales, coal bands, and the fern *Glossopteris*. The old alluvial gold deposits at The Springs are white and more or less clayey, while the recent deposits are ironstained.

At The Springs, one section of which is shown in Fig. 2, page 5, the "billy" occurs on the bottom of the *younger* "lead" with the gold, and with basalt (dolerite) covering it. In other places at The Springs the gold is found in the old *Permo-Carboniferous* lead, a section of which is shown by Mr. Rands in his Report on Clermont,* and also above this in the more recent Tertiary "lead."

The occurrence of fossil remains of animals in a drift or lead at "Flyspeck," on McDonald's Flat near Clermont, has been referred to previously by Mr. Jack,† and during the recent visit to the locality other bones and teeth were obtained.

These have been kindly examined by Mr. De Vis, Curator of the Queensland Museum, who states they are marsupials of two species—namely, *Phascolomys medius* (Owen) and *Macropus majesta* (De Vis)—of early Post-Pliocene Age. With regard to recent deposits, the basalt flow has indicated the Tertiary Age of those which it has covered, but the period at which watercourses were cut into the basalt themselves, and the subsequent formation of shallow leads, is a matter for conjecture.

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* *Loc. cit.*, Plan 1.

† Annual Progress Report of the Geological Survey for the year 1894. Brisbane: By Authority, 1895.

No attempt has been made to trace the boundaries of these deposits or even to separate them from the older formations which they have been derived from or are associated with (except where they illustrate some geological feature), but deposits carrying gold are to be found all over the district either on the sandstones or on the slates and schists. On the accompanying Map are shown the localities where gold has been found on the surface. These deposits are drained by channels leading into Sandy Creek at Clermont, an important consideration from a gold-dredging point of view.

Reference may be made here to the presence of the mineral *zircon* in the leads at Clermont and at the Black Ridge. They have been locally called rubies because of their colour, but they are inferior in hardness to rubies. When heated to redness for a few seconds they lose their colour, a peculiarity very useful in distinguishing them from the much valued gemstone, and also from garnets.

TABLE OF GEOLOGICAL FORMATION AT CLERMONT.

Cainozoic ...	POST TERTIARY ...	Recent alluvial deposits	Black soil. Sandy soil. Shallow auriferous "wash."
	TERTIARY ...	Post-Pliocene deposits ...	Auriferous leads at McDonald's Flat.
		Deposits from aqueous solutions	Magnesian limestone at Langdon, &c.
		Volcanic eruption ...	Flows of Basalt at Wild Cat, Springs, &c.
		Alluvial deposits ...	Auriferous "leads" below basalt.
Mesozoic ...	(?) CRETACEOUS ...	...	Formation (on the surface) of Quartzite ("Billy"), from sandstone.
Palæozoic ...	UPPER PERMO-CARBONIFEROUS	Bowen Coal Measures (approx. in descending order)—freshwater beds	Old auriferous "leads" with *Glossopteris* fern. Coal bands in old watercourses. Old auriferous "leads" with *Glossopteris*. Coal seams of Blair Athol. Probable auriferous deposits below coal seams. Coal bands in the Quarry Hill Shaft. Pebbles of granite, chlorite schist, &c., in the Quarry Hill Shaft.
		Bowen marine beds ...	Ferruginous sandstones, containing shells, &c.
	UPPER DEVONIAN	Burdekin Series	Limestones of Douglas Creek, containing corals, &c.
Age Undetermined ...		...	Slates, schists, auriferous quartz reefs and veins. Granite of Capella and Policeman Creek.

THE BLAIR ATHOL COAL FIELD.

The coal at Blair Athol was discovered in the year 1864, when a seam of coal was penetrated in sinking a well on the Blair Athol Freehold Block. The well was sunk to penetrate the surface basalt below which it is usual about here to find water. Had it not been for this, the coal probably would not have been discovered, as there is absolutely no surface indication to show that coal seams exist below.

Mr. Jack states, with regard to the discovery of the coal, that—"At Blair Athol Station, ten miles north-west of Clermont, in a well 60 feet deep, a seam of coal, together with yellow and grey sandstones, with bands of fine-grained fissile sandstone and shale, were met with, dipping at 10 degrees to the south-east."*

As the result of this discovery, bores were put down by the Peak Downs Copper-Mining Company, and then the Blair Athol Colliery was started in August, 1892, to be followed by the opening of the Hope, Eldorado, and Imbell Collieries. The seam opened and worked by the Peak Downs Copper-Mining Company, in the Blair Athol Colliery, and afterwards by the other companies in the other collieries, was found to be of fine quality, and is the source of all the coal taken out of the mines at present.

At Blair Athol a flow of basalt on the surface was found to be along the line of a *fault*, and it was supposed that where the basalt occurred on the surface it was useless sinking for good coal. This seems to be unreasonable as the basalt at the fault was formed long after the coal. The line of fault possibly might have become one of the boundaries of the basalt when molten, or the fault which disturbed the rocks might have originated a watercourse along which the basalt flowed.

At the Hope Colliery a portion of the lease is covered by basalt, but nothing came under observation which would indicate that the coal there would be inferior because of this.

The probable area of the coalfield, variations in the levels of the coal seams and in the quality of the coal, the quantity of coal available for future use, the gold deposits in the Coal Measures, sites for future prospecting operations, &c., will be treated separately.

Probable Area of the Coalfield.

The area of the coal-bearing formation at Blair Athol is several miles in extent. Taking the Eldorado Shaft as a centre, there is around it an area of about three square miles within which good coal has or will be found. Good coal might be found outside of this area also, and the most probable extension of the field will be to the north and west of the Hope Lease (M.L. 8), and to the west and south of the Imbell Lease (M.L. 9). (See Plate 6, which shows the area and position of these leases.) There is in these directions an area equal to twice the size of the Imbell Lease, probably containing good coal, but further west than this the old formation on which the Coal Measures were laid down will probably be found at a shallow depth.

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* Geology of Queensland and New Guinea. Jack and Etheridge. By Authority: Brisbane, 1892, page 170.

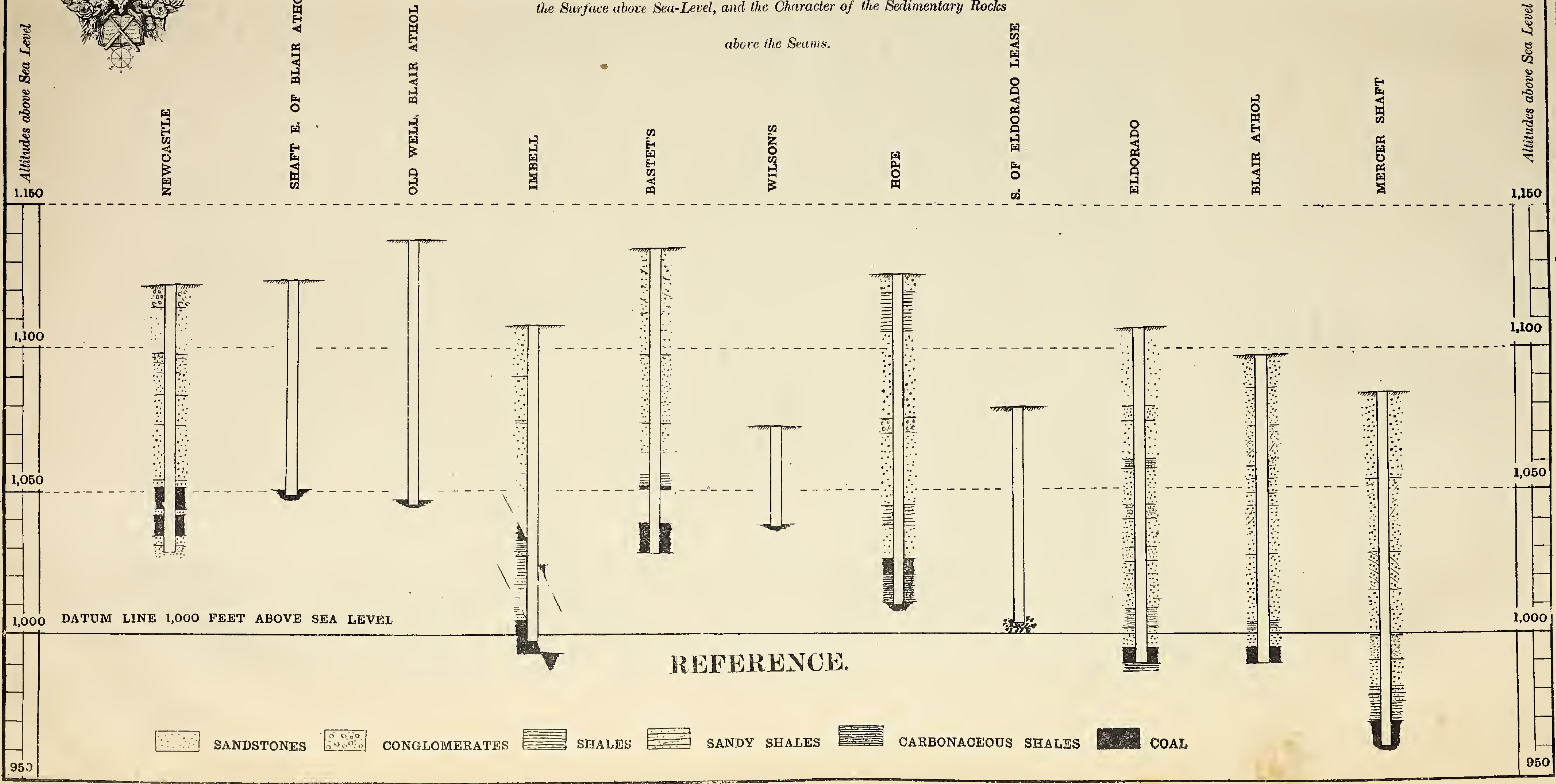
CLERMONT COAL-SHAFT SECTIONS

BY

B. DUNSTAN, F.G.S.,

Assistant Government Geologist,

Showing the Depth and Position of the Coal Seams in each of the Shafts, Altitudes of the Surface above Sea-Level, and the Character of the Sedimentary Rocks above the Seams.



To the east of Mercer's Lease the Coal Measures thin out and appearances are not favourable for their containing a large area of good coal in this locality. To the north of Mercer's and east of Blair Athol the conditions would also be unfavourable.

To the north of the coalfield at Bathampton, the Coal Measures extend under the basalt, and might contain good coal, but nothing has been done to test them in that direction.

Taking everything into consideration, it is very probable that the Blair Athol coal basin contains at least five square miles as coal land, and that future developments might indicate twice this area as being possibly coal-bearing.

The extension of the Coal Measures at Hurley's Diggings has been examined, and although the coal exists there, it can be omitted from consideration entirely. In the vicinity of The Springs and Black Ridge to the north-east of Blair Athol, the country, although containing coal of an inferior quality, does not promise well as the coal is found only in small bands.

The country along Gowrie Creek on the Wolfang Run, to the east of the slate and schist formation (see accompanying Map) might possibly contain coal, but from the indications shown in the Quarry Hill Shaft and the Enterprise Shaft near Clermont (see Plate 1), and also in what is seen at The Springs, the chances of finding coal other than in bands is very remote.

On the Wolfang Run a great number of wells have been sunk through black soil, basalt, and various kinds of sandstone, and they point to the occurrence of shallow deposits of what probably are Coal Measures. They exist under the basalt and over a large area, but of all the wells sunk none have penetrated coal or anything resembling coal.

At Clermont the presence of the Marine Beds in the Quarry Hill Shaft indicates that the main coal-bearing beds (the equivalents of the Blair Athol Beds), if they existed at all, must have been denuded and washed away from above the slates and schists now outcropping on the surface.

At Flyspeck, to the south of Clermont and near Copperfield, some coal bands three or four inches thick have been passed through in shafts that have been sunk to prospect the alluvial deposits for gold, but the conditions are not favourable to the formation of even a small area of Coal Measures that would contain coal seams of sufficient thickness for working.

VARIATIONS IN THE LEVEL OF THE COAL SEAMS.

The variations in the level of the seams in all the shafts are shown on Plate 2, and a datum line is placed to represent 1,000 feet above sea level. The position of the coal in each of the shafts is shown with relation to this datum line, also the altitude of the surface at each of the shafts.

This will prove useful in future developments, as the difference of level between two places (say between the shafts at Blair Athol and Newcastle) will indicate the relative position of the coal at any spot between them, and so also indicate the probable inclination of the coal seams.

It must not be forgotten that between two collieries or shafts there will be fluctuations in the seams, and they will sometimes dip in a direction contrary to what might be expected. As an example the Hope Mine may be taken. The underground workings of this mine show that several apparent dips occur, indicating that at the south-west end of the mine the coal seam dips to the north-east at about an inclination of 5 degrees, while at the north-east end the dip of the seam is to the south-west. As these local inclinations together have the effect of producing a trough near the shaft, other troughs or depressions might exist, but all will have a general direction striking north-west and south-east. (See Plate 5.)

Again, between the Eldorado and the Hope there is a difference in level of 30 feet (see Plate 2, showing sections of the shafts), and although the workings of the Hope do not indicate an inclination towards the Eldorado, yet the inclination must exist, and when the seam is driven on toward the south-east, the further the coal is found to keep level with the present workings at the same end of the colliery the more severe the inclination will be when it is found.

At the Eldorado Mine water is met with at the southern workings in the abandoned bords and in the main heading. The water probably comes from the direction of the Hope and passes by the Eldorado to the west, south-west, and south, and makes for the south end of the Blair Athol Lease. The Imbell fault might augment the quantity by allowing surface water to percolate through to the coal seam and then to follow the seam down in the direction of the dip at the Imbell Mine.

The dip at the Imbell is about 5 degrees north-easterly, and the coal will most likely continue to dip in this direction until it crosses the boundary of the lease and meets with the water the Eldorado has struck in its workings. The presence of the fault at the Imbell might have some effect in preventing water making its appearance in the present workings; but in future the coal on the southern side of the fault might prove more troublesome to work if it has the same inclination as the seam on the northern side.

The coal basin as it existed during the Permo-Carboniferous Period might not have been very much inclined whereby the area would be drained, although the present position of the coal seam at Mercer's Shaft indicates a difference in level of 80 feet from the seam in the Newcastle Shaft—taking the top of the seam in both cases as a basis for estimation—in a distance of about 65 chains. The coal in Mercer's Shaft is at the lowest position on the coalfield (see Plate 2), but it does not, therefore, indicate that direction being the outlet for the water which flowed into the coal basin, but rather that the Measures, subsequent to their formation, have undergone local subsidences. The coal in the Newcastle Shaft rests on the slates, and being shallow has suffered no alteration in level, and it might be inferred from this that the coal in Mercer's Shaft having subsided so much the Measures there would be very deep. If the subsidence be due to a shrinkage in bulk of the material composing the rocks, such as would be the case if they are composed of shales, it may be inferred that the Measures are certainly very thick at Mercer's; but that if the subsidence is due to a movement in the rocks of the older formation below, no inference regarding the thickness of the formation could be drawn.

From a general point of view it can safely be stated that the Coal Measures have been lowered from their original position at all places except where the coal occurs in the Newcastle Shaft; that the maximum amount of movement has taken place where the coal occurs at Mercer's; that there is a slight inclination in the coal seam from Bastel's Shaft through the Blair Athol Lease and Freehold down towards the Newcastle and Mercer's boundary, and that between Mercer's Shaft and the Newcastle Shaft there is a possibility of the coal strata being broken by a downthrow fault on the eastern (Mercer's) side.

RETURN OF COAL OUTPUT—QUANTITY AND VALUE.

OUTPUT OF COAL FROM THE BLAIR ATHOL COAL FIELD TO 30TH SEPTEMBER, 1899.

The following returns have been supplied by the Railway Department showing the coal received from the Clermont district. As almost all the coal obtained from the mines is received for railway consumption, these returns represent nearly the total output up to 30th September, 1899. A thousand tons, it is understood, would perhaps represent the maximum quantity consumed locally up to the same date:—

Date Contract Let.		Name of Mine.	Price per Ton.		Quantity Supplied.			Total.		
			s.	d.	T.	C.	Q.	T.	C.	Q.
1890—June	23	Peak Downs Copper and Coal Mining Co. ...	21	0	250	0	0			
August	28	Ditto	21	0	3,016	16	3			
1891—February	5	Ditto	20	9	3,066	0	0			
August	10	Ditto	20	0	3,000	0	0			
1892—January		Ditto	20	0	500	0	0			
January	31	Ditto	20	0	3,069	10	0			
July	2	Ditto ... ... (over supply)	18	0	100	0	0			
September	8	Ditto	19	0	3,000	0	0			
1893—March	28	Ditto	19	0	2,515	14	0			
1894—January	5	Ditto	19	0	4,008	4	0			
1895—January	11	Ditto	17	9	1,580	16	1			
September	11	Ditto	19	0	6,004	8	2			
1896—October	2	Ditto	19	0	3,002	19	0	33,114	8	2
1892—May	22	Eldorado Colliery (Jensen and Co.)	19	6	104	15	0			
July	26	Ditto	17	10	3,000	0	0			
1893—March	28	Ditto	19	0	2,500	0	0			
1894—January	2	Ditto	19	0	2,999	7	0			
1895—January	11	Ditto (Smith, Jensen, and Co.)... ...	17	9	1,498	3	2			
1898—January	25	Ditto (McKean and Petersen)	17	9	4,000	17	1			
1899—July	12	Ditto ditto	16	10	449	14	0	14,552	16	3
1895—January	11	Hope Colliery Co., Ltd. (C. Niedermeyer and Co.)	17	9	1,502	1	0			
July	31	Ditto	17	9	1,000	0	0			
September	11	Ditto	19	0	4,999	15	0			
1896—October	2	Ditto	19	0	3,007	13	0			
1899—February	21	Ditto	17	0	2,002	5	0			
August	10	Ditto (at Imbell Company's risk) ...	*16	10	253	14	0	12,765	8	0
1896—January	23	New Eldorado Colliery	18	0	48	7	0	48	7	0
1896—February	17	Newcastle Colliery Co.	18	0	50	11	2			
August	26	Ditto	18	0	48	12	0	99	3	2
1898—August	11	Imbell Colliery (Thomas and Spring)	17	0	4,014	7	0			
1899—May	26	Ditto (in existence)	16	10	751	19	0	4,766	6	0
		Total	...		...			65,346	9	3

* Net

From the above statement it will be seen that the total quantity taken out of the mines, exclusive of local consumption, is 65,346 tons, and would, at the average rate of 18s. 9½d. per ton, represent a total value of £61,461.

COAL AVAILABLE IN FUTURE—QUANTITY AND QUALITY.

From what has been stated generally regarding the Coal Measures, and the Blair Athol Coal Field in particular, a fair estimate can be obtained of the quantity of coal contained in them.

THE TOP SEAM.

Taking the area of good coal land as three square miles, and allowing only four feet as the minimum thickness of the top seam, which we will consider first, and assuming the average specific gravity of the coal in bulk to be 1·2, we have 2,022½ lb.—a little less than one ton—in one cubic yard (a ton of coal would contain about $1\frac{1}{10}$ cubic yards), and in an acre over 5,000 tons. In the whole of the area of three square miles there would be over 11,000,000 tons. If only two-thirds of this could be utilised, taking one-third from this for what has been already taken out, and for waste, pillars, &c., we would still have over 7,000,000 tons as the *smallest* estimate of the quantity of the best Clermont coal available. Any allowance over 4 feet in thickness would, of course, make a corresponding increase over this amount.

This 7,000,000 tons would have approximately the following composition, being the mean of all the analyses made of the top seam:—

ANALYSIS OF BLAIR ATHOL TOP SEAM.

Moisture	5·6
Vol. Hyd. Carbons	32·4
Fixed Carbon	57·5
Ash	4·5
Sulphur...	Trace

The LOWER SEAM is proved to extend over a larger area than the top seam, and this area can be taken as five square miles.

The thickness of the seam may be taken as twelve feet, but this is about three or four feet under the average. In an acre there would be about 17,000 tons, while in the whole area of five square miles there would be about 56,000,000 tons of coal, or about 37,000,000 tons available for use. Taking the two seams together there would be a total minimum quantity available of 44,000,000 tons.

The quality of this coal may be gauged from the following mean approximate analysis:—

ANALYSIS OF BLAIR ATHOL LOWER SEAM.

Moisture	5
Vol. Hyd. Carbon	27
Mixed Carbon	61
Ash	7
Sulphur	Trace

It has about the same specific gravity as the coal in the top seam, and so would be about the same in bulk—that is, a cubic yard would weigh a little less than a ton.

As the coalfield has not been prospected in depth nothing is known below the second seam. This seam is about 120 feet from the surface and only a few feet below the top one, but from what has been already stated with regard to the extent of the field it is extremely probable that the Measures are much deeper than this, and possibly other seams will be found to increase the already large amount of coal known to exist.

GENERAL REMARKS.

Samples of coal from all the mines were obtained for examination, and most of these have been tested by the Government Analyst. They show that the coal in the Blair Athol, Eldorado, Hope, and Imbell Collieries vary but slightly in quality from one another, although portions of the seam occasionally are found to be inferior and dull in appearance. In all of them it is necessary to exercise care in removing dirty portions of the coal, otherwise the "ash" increases considerably above that shown in the table of analyses following.

In the Newcastle, Mercer's, and Bastet's Shafts the coal has a perished appearance, and there is a difficulty in understanding why this is so. In the centre of the field the coal is bright, and at the places mentioned it might be supposed that the dullness and apparent inferiority of the coal has been produced by its proximity to the older rocks near the edge of the coal basin. This, however, does not appear to be so, as the coal from the Mercer's Shaft shows from analysis a rather large percentage of ash, while the same kind of coal at Bastet's shows a very small percentage. It has been observed also that in places around Clermont, although only a few hundred yards from the edge of the formation, the coal is quite bright and very free from impurities. At "Flyspeck," on McDonald's Flat, to the south of Clermont, in a narrow tongue of Coal Measures 400 yards wide and 100 feet deep, three bands of coal occur about four inches thick and of very good quality.

It has been suggested that the basalt on the surface has caused the deterioration of the coal, although the seam varies from 70 feet to 100 feet in depth below the basalt. It is quite possible, however, that the basalt flow has, when molten, covered some springs or water channels, and that the imprisoned steam generated from the water below the heated lava has permeated the strata and removed as gas a portion of the hydro-carbons from the coal.

From the analyses of the coal given further on, and from a general comparison of the coal sections shown on Plate 2, it is evident that the three shafts which have struck the thick seam—*i.e.*, Newcastle, Mercer's, and Bastet's—also resemble each other in the quality of their coal. From what information could be obtained concerning the thick seam in some of the other shafts and below the top seam worked at present by the Blair Athol, Hope, Eldorado, and Imbell, it is probable that it is of somewhat the same quality in all the mines.

Applying this information generally, it may be supposed that the coal in Mercer's, Bastet's, and the Newcastle Shafts belong to one and the same seam—the lower thick seam—and instead of the appearance of the coal in that seam being locally affected by surface agency, it is its inherent quality throughout the whole of the field.

With regard to the coal on the outskirts of the field, little need be said. The quality in some cases is good, but the quantity is so small, and in thickness amounting only to a few inches, that working the deposits is entirely out of the question.

The suitability of the Clermont coal for coking has not been demonstrated satisfactorily. The test made by the Government Analyst indicates that the coal does not coke; but some coals will not coke unless burnt within twenty-four hours after being mined,* and the samples submitted had been exposed for several weeks before they were tested. Some of the men engaged in the mines assert that the coal will coke when just brought to the surface, and that it was a common practice to fill a clay pipe of the Blair Athol coal, and after burning off the gas to show a small piece of coke in the pipe as a result of the experiment.

Undoubtedly the coal will require special care in treating, and perhaps special machinery too if coke-making is to be introduced, so for the present we might sum up the conditions as to cost, &c., as being unfavourable. That other seams might exist below must not be forgotten, and these might yield coking coals.

The suitability of the coal for railway purposes has long been recognised by the stokers on the locomotives, and also by the blacksmiths. The former have very little trouble in cleaning the fireboxes when using the coal, and the coal burns very freely and leaves very little ash. In a copy of a memo. to the Commissioner for Railways, Mr. W. H. Nisbet, Chief Mechanical Engineer to the Railway Department, states that "several thousand tons of coal from the Clermont District have been used on our locomotives within the last nine years with fairly satisfactory results. This coal deteriorates very much from exposure to the atmosphere, and a trial made a few years ago of coal after being exposed for a considerable time showed that the percentage of ash about doubled. There is not an extraordinary amount of flame or smoke with newly raised coal, but some ashes and slaty matter, which, however, are

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See Percy's Metallurgy; Fuel—coking coals.

easily removed from the firebox. Some trials were made in 1895 to see how this coal compared in consumption with other coals then being used on the Central Railway, reports concerning which were sent you at the time. These tests showed the following results :—

LOCOMOTIVE TESTS OF COAL.

" Wyralla, New South Wales	147 lb.	per train ton mile
Maryborough, Queensland	153	ditto
Bundâmba, ditto	156	ditto
Clermont ditto	182	ditto."

In the above memo. the statement that the coal deteriorates very much from exposure might be quite correct, but that the percentage of ash is about doubled is rather extraordinary. The ash increase might be due to the accumulation of dust from some outside source.

Ash is the incombustible material or residue after the carbon, &c., is removed, and consists usually of silica, lime, potash, magnesia, alumina or iron oxides, or admixture of some of these substances, and nothing, so far, has been discovered which would account for the increase of these incombustible substances in a coal from simple exposure.

For blacksmiths' use Clermont coal is undoubtedly the best that has been found in Central Queensland, and some blacksmiths affirm that it is better than Newcastle (N.S.W.) coal for that purpose. It does not, however, cake or bind together in the forge under ordinary conditions, from which fact might it be judged as to its comparative worth.

For local consumption the blacksmiths prefer a coal with thin white flakes of kaolin in the joints, not because of the presence of this mineral in the coal, but because the coal which contains it is the most suitable for their work.

The percentage of sulphur is almost a negligible quantity as all the analyses only show traces of this substance. In examining the coal at the pit mouth it was observed that the joints in places contained sulphide of iron as *marcasite* (a variety of pyrites), and in some of the bords in the mines the percentage of this mineral would give considerably more than traces of sulphur.

A factor of importance in limiting the output is the cost of transit to the railway from the mines. The cost averages 10s per ton,** but this would be avoided were the mines connected with Clermont by a branch railway line. This would also prevent much of the handling at present necessary. The distance from Clermont to the mines by road is about thirteen miles, and by the proposed branch railway just ten and a-half miles to the centre of the field.

A frequent complaint by the stokers using the coal on the railway locomotives is the presence of inferior coal mixed with the good coal, this inferior coal being locally but indefinitely termed "fault" coal. Where the coal is faulted in the Blair Athol Mine the coal acquires a dirty, dull appearance; and the coal away from the fault, although just the same in appearance, is still called "fault" coal, instead of inferior or "dirty" coal. In the other mines the same term is used.

So little attention is paid to keeping the coal clean that frequently large pieces of sandstone or clay ironstone are included with the coal. This might be looked upon with indifference by the proprietors of the mines so long as no complaints are made, but ultimately it must have the effect of creating abroad a bad impression with regard to the quality of the coal, and perhaps necessitate stringent measures being adopted to prevent this dirty coal from being put out with the best coal. In some coal districts the coal is sampled in the railway trucks, and on the result of analyses payment is made to those supplying the coal. This is a very fair method, as it is a check both on the buyer and seller.

In the following table are shown the analyses of average samples of Clermont coals :—

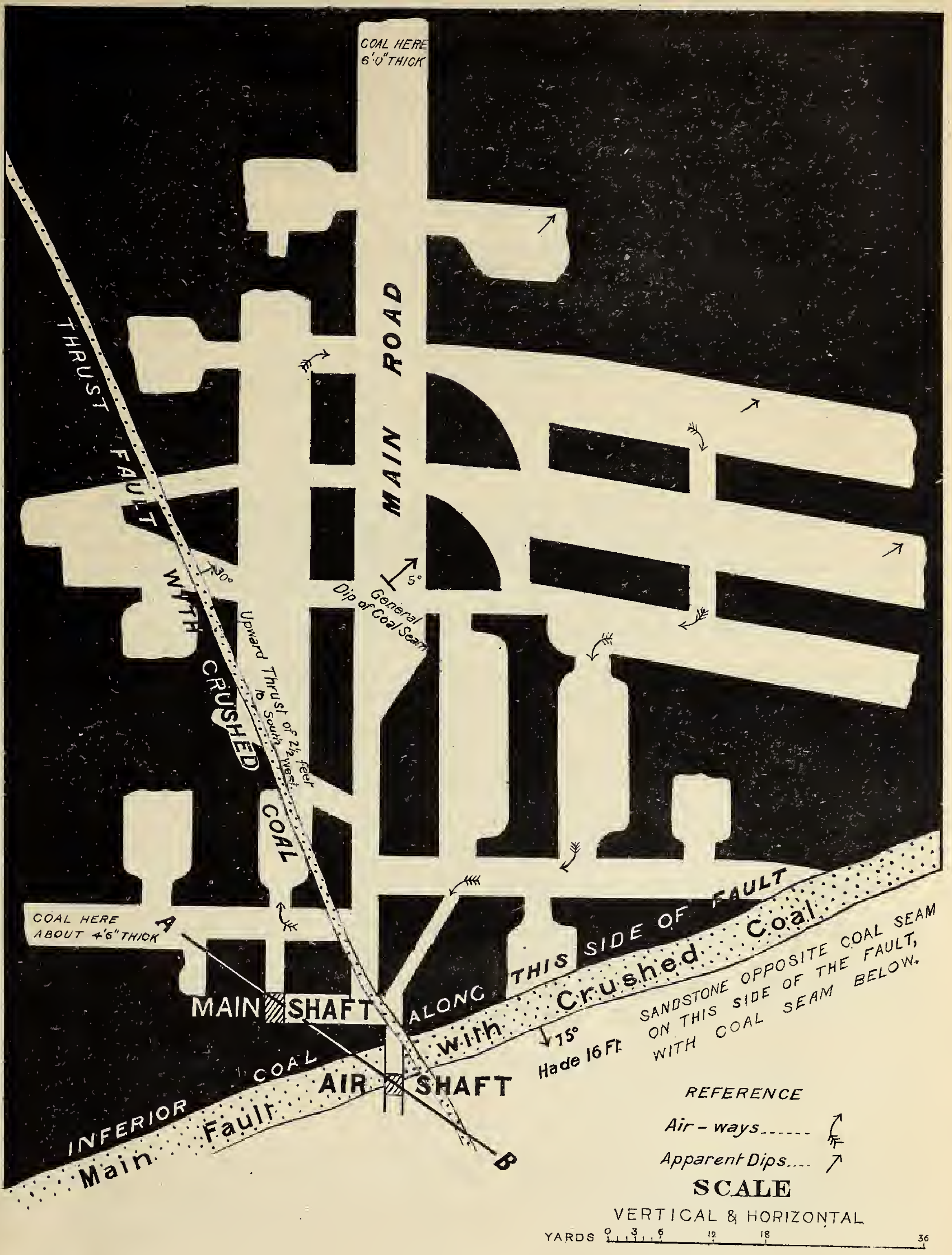
TABLE OF ANALYSES OF CLERMONT AND OTHER QUEENSLAND COALS.

—	Moisture.	Volatile Hydro-Carbons.	Fixed Carbon.	Ash.	Sulphur.	Specific Gravity (in powder).§	Remarks.
West Moreton Coals—							
Aberdare, Blackstone	1·74	33·10	60·64	4·52	0·74	...	Picked from samples supplied by proprietors for exhibition purposes.
New Chum, Whitwood ...	2·07	30·50	64·13	3·30	8·11	...	Ditto
New Chum, Dinmore	1·05	28·70	60·07	9·55	1·68	...	Ditto
No. 2 Seam, Swanbank ...	2·10	29·65	59·95	8·30	1·68	...	Ditto
Tivoli Seam, Waterstown ...	0·55	28·00	66·00	5·45	1·29	...	Ditto
Burrum Coals—							
Torbanlea	3·25	25·20	58·40	13·15	1·72	...	Ditto
Howard	1·40	28·15	65·40	5·05	1·37	...	Ditto
Wright's	1·48	26·25	70·72	1·55	0·76	...	Ditto
New Riverbank	1·10	27·50	69·25	2·15	0·70	...	Ditto
Styx River Coal	2·2	31·3	62·6	3·9	...	(—)	
Stanwell Coals—							
No. 1	8·40	24·49	57·36	9·5	0·25	...	(Dixon).
No. 2	9·15	26·71	51·24	12·62	0·28	...	Ditto
No. 3	9·95	23·63	54·20	12·04	0·18	...	Ditto
Bowen River Coal	7·18	46·66	37·89	8·29			Mean of several samples stripped from exposed coal face.
Dawson Coal	3·75	12·98	78·45	4·84	Trace...	...	
Capella Coal	0·82	57·52	32·38	9·28	3·85		
Callide Coal*	9·25	25·29	55·66	9·60	0·23		
Clermont—							
Quarry Hill	3·9	36·0	30·9	25·0	4·5		
Imbell	5·69	32·30	57·18	4·83	Trace...	1·33	Ash, white; slightly caking
Mercer	4·51	26·21	59·17	10·08	,, ...	1·43	Ash, white; slightly caking
Eldorado	5·39	34·16	55·72	4·28	,, ...	1·33	Ash, white; caking, but coke friable
Bastet	5·27	27·41	62·07	5·27	,, ...	...	Ash, white; non-caking
Hope†	5·61	30·60	59·73	4·06	,, ...	...	Ash, white; non-caking; sample previously exposed
Hope‡	4·37	21·39	53·05	21·18	,, ...	...	Ash, white; non-caking; sample previously exposed

* Average of best four samples taken by Mr. Rands, 1891. † Sample of the best coal. ‡ Sample of the inferior coal.

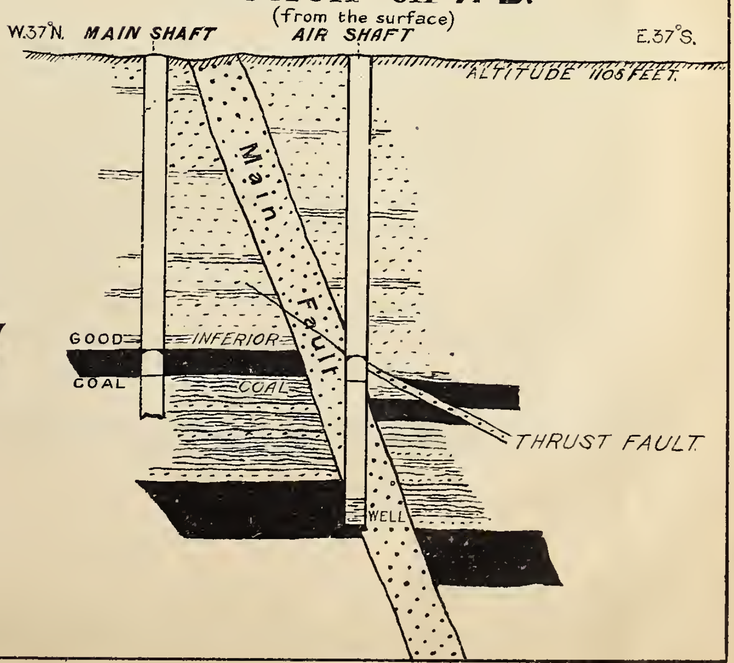
§ In bulk the specific gravity of the Clermont coal is about 0·1 less.

** The cost per ton of winning and carting the coal at Blair Athol Colliery when working was as follows :—Hewing, 4s. 3d. ; cartage, 10s. ; top expenses, 6d.; timbering, 6d. ; incidental, 6d. ; total, 16s. 6d. Royalty : 1d. per ton from freehold, 3d. per ton from leasehold.


COAL HERE 6'0" THICK
MAIN ROAD
THRUST FAULT WITH CRUSHED COAL
Upward Thrust of 2½ feet to South-west
30°
5°
General Dip of Coal Seam
COAL HERE ABOUT 4'6" THICK
A
MAIN SHAFT
AIR SHAFT
B
INFERIOR COAL ALONG THIS SIDE OF FAULT
Main Fault with Crushed Coal
75°
Hade 16 Ft
SANDSTONE OPPOSITE COAL SEAM ON THIS SIDE OF THE FAULT, WITH COAL SEAM BELOW.
REFERENCE
Air-ways
Apparent Dips
SCALE
VERTICAL & HORIZONTAL
YARDS 0 3 6 12 18 36

Section on A B.

(from the surface)



PLAN
OF
Underground Workings
IMBELL COLLIERY
CLERMONT
BY
B. Dunstan F.G.S.
Assistant Government Geologist.
1900

LEONARD C. GREEN, Del.

THE COLLIERIES AND PROSPECTING SHAFTS.

It is proposed under this heading to give some details regarding the collieries, the shafts which have been sunk to prospect for coal, and the places where coal has been found either in sinking for water or for gold.

Blair Athol Colliery.

This is an important mine on the field, and it was intended to include in this description a plan of the workings. The original plans of the mines which were to have been made use of in connection with this Report have been either destroyed or lost, and relying on seeing these plans special attention was not given to prepare drawings for publications. The absence of this information is to be regretted, as this portion of the work remains almost a blank.

After the discovery of the coal at the old Blair Athol Well, some trial bores were put down by M. Joubert. The first company formed to work the coal was a Sydney one called the "Peak Downs Copper-Mining Company," who acquired the ground to obtain coal for copper smelting at Copperfield. In 1879 the assets of this company were handed over to a local company called the "New Peak Downs Copper-Mining Company." In 1892 the present company, called the "Peak Downs Coal and Copper Mining Company," took possession. Recently the "Optionists" Syndicate have taken over the coal and copper properties for flotation purposes.

The coal property of the Peak Downs Coal and Copper Mining Company is comprised in two blocks of land—a Freehold (269) of 100 acres, and a Lease (M.L. 5) of 410 acres. This position of these blocks will be seen on reference to Plate 6, showing the leases, &c., on the coalfield.

The main shaft is in size about 7 feet by 3 feet, and in depth 100 feet to the top of the coal seam, and about 111 feet to the bottom of the well. The strata passed through in sinking consisted chiefly of sandstones with dark shales and white fireclay. The seam averages 4 feet 10 inches in thickness, and below this is 1 foot 6 inches of shale, then sandstone, and then coal bands at 3 feet below the floor of the coal seam.*

The coal seam undulates slightly with a general inclination of 1 in 60; but occasionally this dip is steeper. From the main shaft it dips easterly 1 in 30, in the south-western workings it is almost level, and in the north-western workings it dips northerly 1 in 30, and further away from the shaft rises 1 in 60.†

No samples were taken of the coal for analysis, as the coal on the surface has been exposed so long that the result would have been unsatisfactory. The quality, however, would be very similar to that of the Hope and Eldorado coal.

The fault in the Blair Athol Mine occurs at the end of the eastern heading, and the direction from there is north-westerly. The amount of throw of the fault has not been determined as no work has been done on the other side, neither is it known which is the downthrow side of the fault.

There are three main headings, each 4 yards wide, one going north-west for 140 yards, one east for 140 yards, and one south-west for 170 yards.

The number of bords open are fifteen or sixteen, but several have been abandoned in the workings at the end of the south-west heading, and near the fault to the east and south-east.

From the main shaft the air shaft is 66 feet slightly to the east of north. The air currents first pass to the north-west workings, along the south-west heading to near the main shaft, then to the workings to the south-east, next to the east heading, and thence to the air shaft where the furnace is placed.

The output of coal commenced during the year 1890 and continued up till 1896 when the mine stopped working. The quantity taken out amounted to over 33,000 tons. (For details of the coal production see page 10.)

Imbell Colliery.

This colliery was opened by Messrs. Thomas and Spring in 1898, and the first delivery of coal to the Railway Department took place in August, 1899. The Lease, M.L. 9, of 90 acres (Thomas and English), is on the western side of the Eldorado, with its northern boundary in part adjoining the most southern boundary of the Hope Lease. There are no leases joining the property on the north-west, west, or south (see Plate 6).

The surface here, as is mostly the case where the rocks of the Coal Measure are not covered by basalt or "billy," is a sandy soil, the slope of the ground being from the north-eastern corner to the west and south-west towards Gowrie Creek, and to the south towards the "Washpool." Where the shafts are sunk the altitude of the surface is 1,105 feet above sea level, this being about eleven feet higher than the top of the Eldorado main shaft, and about ten feet lower than the Hope main shaft. (See Plate 2.)

The main shaft at the Imbell (6 feet by 4 feet) is in the north-eastern corner of the lease, being about 100 feet from both the northern and eastern boundary. The depth of the shaft from the surface to the top of the coal seam is 70 feet, about 74 feet to the floor, and about 80 feet to the bottom of the well.

In sinking the air shaft the coal was not found at the depth it was expected, and a fault was discovered which had thrown down the coal seam seventeen feet lower than in the main shaft. (In the drawing of the section on Plate 3, in illustration of this, it is incorrectly shown less than seventeen feet). Fifteen feet below this the lower thick seam was found on the same side of the fault as the main shaft. The presence of this fault will have an important bearing on subsequent development, when the coal has to be taken out from the side opposite to that now worked.

Another fault having an upward thrust of two feet six inches disturbs the coal beds. Apparently it is more recent than the main fault, as the disturbance can be traced into the fault-rock at the furnace near the air shaft. The following illustration (Fig. 5) shows the manner in which this thrust fault has broken the coal seam, together with the rocks above and below it. The material in the fault is made up of coal dust and rock débris, the coal dust being diffused in the fault above the level of the coal, and the rock débris being mixed with the hard coal in the seam:—

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* These and other details have been supplied by Mr. Howard Smith, and are slightly different from those given by Mr. Jack in his "Progress Report for the year 1894."

† To reduce such values (as 1 in 30) to degrees, divide (the 30) into 60; 1 in 7½ gives 8 degrees, which is absolute; but all values higher or lower than this are only approximate. The error becomes excessive in angles greater than 1 in 4, but in small angles the error for practical purposes can be neglected.

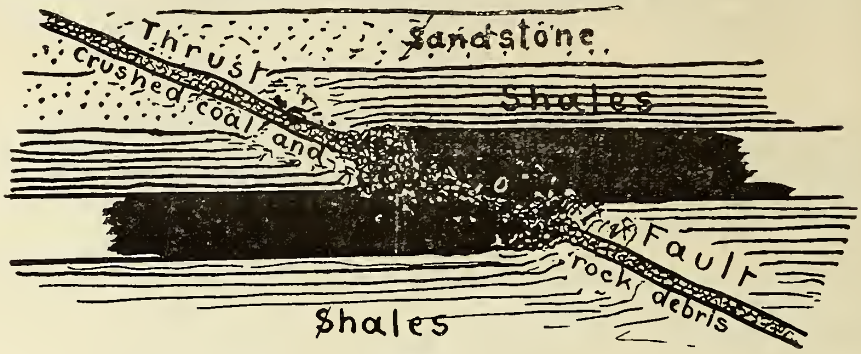


Fig. 5.

Section of the Imbell Fault.

DISLOCATING THE COAL SEAM BY AN UPWARD THRUST.

The top seam of coal at the main shaft is three feet eleven inches thick, but in the northern workings, which extend to the northern boundary, the seam is six feet thick. To the west of the main shaft the seam becomes thicker also, and the workings furthest west show the thickness to be four feet six inches.

As in some of the other mines the seam will abruptly decrease in thickness by an accumulation of hard carbonaceous sandstone on the floor, or by a similar accumulation below the normal level of the roof. These undulations amount sometimes to as much as two feet. Sometimes the good coal decreases in thickness by an accumulation of inferior coal on the top. This inferior coal is found throughout the workings, varying generally from six inches down to one inch.

The general dip is about 5 degrees to the north-east, although there are apparent dips fluctuating from this.

For the plan and vertical section of the underground workings see Plate 4.

The quality of the best coal is very similar to the best coal of the other mines, and the quality of the inferior coal similar to that of the Hope, with, perhaps, a little less percentage of ash than what is shown by the analysis of that coal. (See Table of Analyses on page 12.)

The lower seam is apparently the same as that found at the bottom of Bastet's Shaft, and probably is similar in composition, as it resembles it in other respects.

Regarding coking qualities, the coal, after some weeks' exposure, was determined by the Government Analyst to be a slightly caking one. Probably its coking quality would be improved were the coal to be burnt as soon as possible after it is brought up to the surface.

Since the first delivery of coal to the Railway Department in August, 1898, to the 26th of May, 1899, the Imbell Colliery has taken out 4,766 tons of coal, and at present have a contract in hand for a further supply.

Eldorado Colliery.

This colliery was opened in 1892, and the first supply of coal was taken out in May. The Lease, M.L. 6, has an area of 80 acres, is bounded on the north by the Hope, on the east by the Blair Athol, and on the west by the Imbell. The south boundary is close to the Carriers' Reserve.

In the north-west corner a small *outlier* of "billy" occurs, but otherwise the surface is sandy soil formed from the rocks of the Coal Measures. The ground gradually rises from the south end of the lease to the north end, and between these two boundaries there is a difference in level of 50 feet.

The main shaft is six feet by four inches in section, and in depth is 102 feet to the top of the coal, and 108 to the floor. The air shaft is four feet by two feet six inches, and from the main shaft is about 80 feet in a nearly west direction.

The thickness of the seam varies. At the shaft it is six feet, towards the south seven feet, in the east heading it is five feet six inches, and in the north heading six feet six inches.

The seam has not been disturbed by a fault so far as the present workings show, but there is a probability of one existing to the north-west of the shaft, as the Imbell fault having a north-east strike will probably be found in this direction. The fault, however, having only a throw of seventeen feet, might have diminished or even died out before it reached very much further than the Imbell boundary.

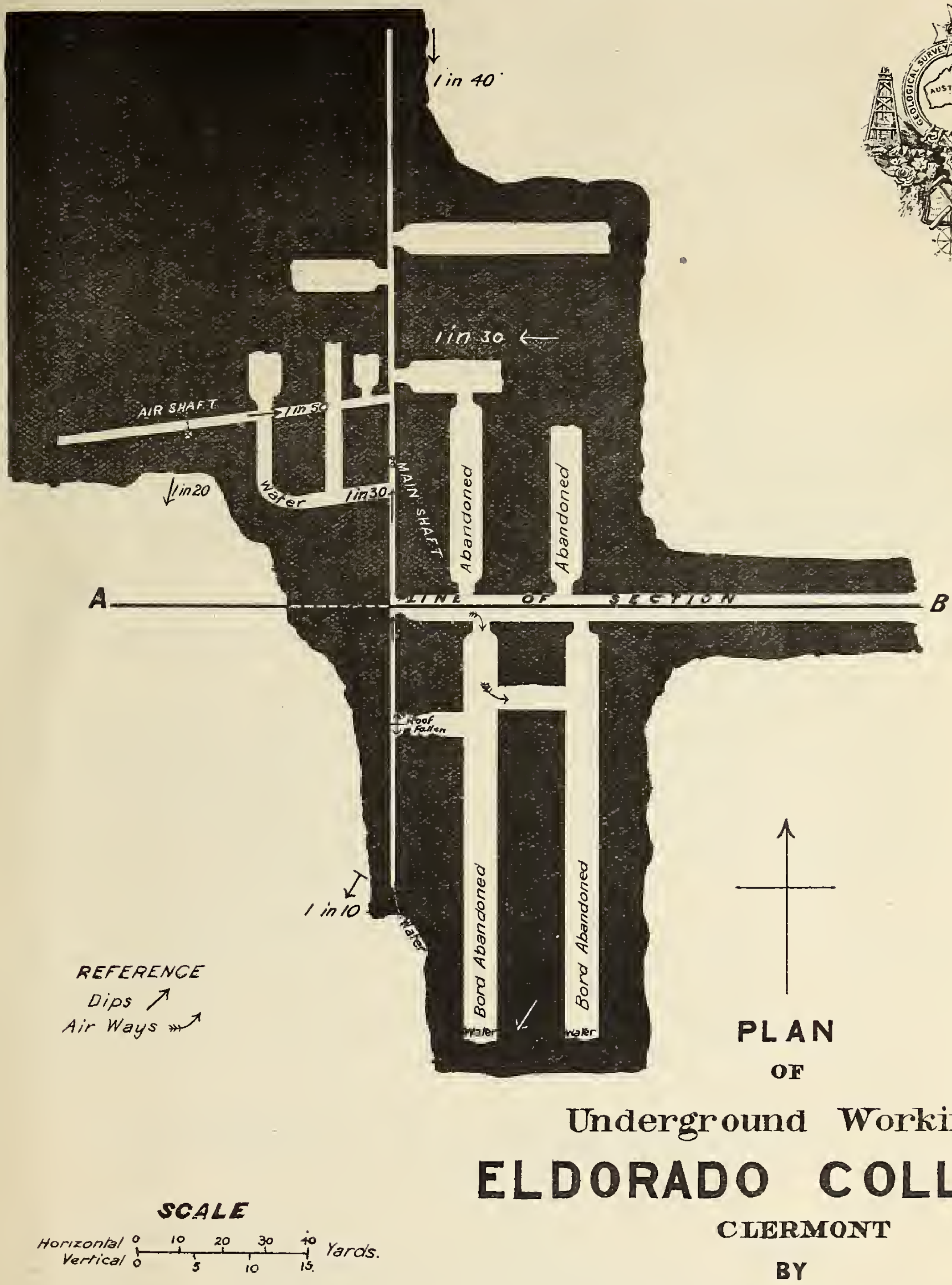
With regard to the water found in the southern workings, and which caused them to be temporarily abandoned, reference has been made to it on page 9, under "variations in the level of the coal seams." On Plate 4 the positions of these abandoned bords are shown, together with other information concerning the underground workings and the inclination of the coal.

The quality of the coal is very similar to that of the Hope and Blair Athol Collieries, but it has the highest percentage of hydro-carbons of all the coals on the field—an important item when considering their gas-making qualities. Occasionally the quality of the coal sometimes varies in one spot, the better class of coal generally being at the bottom of the seam. The thickness of the inferior coal varies from seven inches to two feet six inches, in the latter case due to sudden undulations in the roof. These undulations do not affect the good coal.

Hope Colliery.

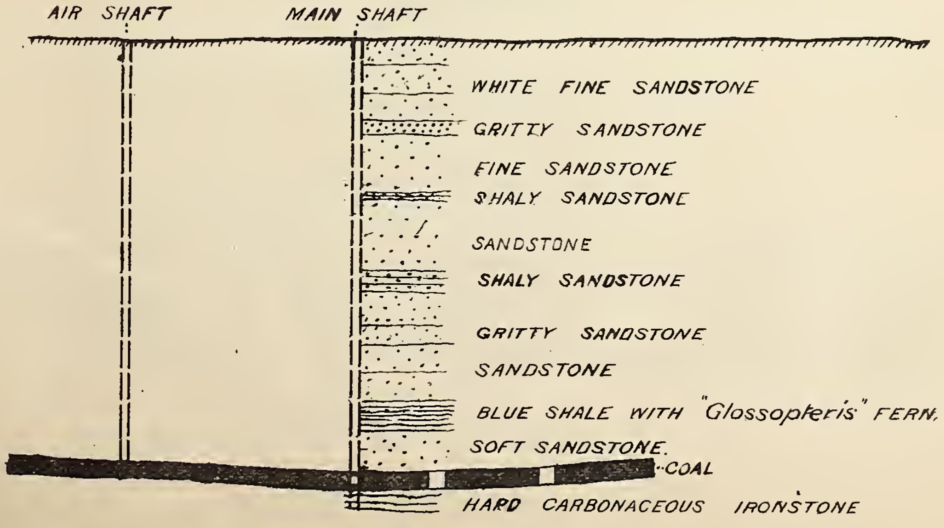
This mine was opened in 1894, about two years after the Blair Athol Mine started operations. The Lease, M.L. 8, consists of 120 acres on the western boundary of the Blair Athol block and on the northern boundary of the Eldorado and Imbell Leases.

Sandstones are exposed on the surface, but masses of "billy" occur in places. About ten acres in the north-west corner are covered by basalt and black soil.



PLAN
OF
Underground Workings
ELDORADO COLLIERY
CLERMONT
BY
B. Dunstan F.G.S.
Assistant Government Geologist

Section on line A B 1900



Leonard C. Green del.

The main shaft is in a position nearly the highest on the coalfield, being 1,115 feet above sea-level. For particulars with regard to the shafts and other underground workings see Plate 5.

The coal seam is uniform in thickness, seldom varies from five feet, is without faults or disturbances, and is inclined generally at a low angle. From the numerous dips observed throughout the workings it is evident there are two slight depressions forming slight troughs or gutters in the coal seam. Both these depressions are to the west of the main shaft, the first one rising slightly to the north-west and turning around to the north of the shaft to about half-way along the bord there. The other depression begins about 22 yards up the long bord furthest west, crosses the west heading and joins the first depression about 50 yards south of the main shaft, and continues to fall with just a perceptible inclination as far as the workings in this direction extend.

Two general dips can be made out—one to the north-east, the other to the south-west; and as the depression between them is inclined to the S.S.E., this is the direction where the seam would be found lowest.

The quality of the coal in this mine, as in all the others, varies to some extent, and on referring to the analyses on page 12, the two qualities show a great difference in the percentage of *ash*. As the quantity of the inferior coal in the seam is small, its presence is of no great import.

From the analysis the good coal is shown to be non-caking, but the sample was taken from a heap which had been exposed on the surface for some months. This exposure might also have affected the percentage of hydro-carbons, which the analysis shows to be nearly 4 per cent. less than that in the Eldorado coal. The seam below the one at present worked has been penetrated in the well, but a sample was not obtainable.

The first delivery of coal from this mine to the Railway Department took place in the beginning of 1895; up to the beginning of 1899, when the mine stopped working, the total coal output reached 12,765 tons.

Mr. Jack published some particulars given him about this mine,* but the depth of the shaft as obtained recently from Messrs. Bastet, Neidermeyer, Joyce, and Derritt is different to what he has stated, and is 105 feet to the top of coal, 110 feet to the floor, which is a clayey and carbonaceous sandstone, and 120 feet to the next seam of coal.

The Newcastle Shaft.

This mine was opened in 1895. The Lease M.L. 10, 320 acres, is on the southern boundary of the Blair Athol Lease, and west of Mercer's Lease. The southern boundary extends into slate country, and the western boundary adjoins the Carriers' Reserve.

The surface of the lease is not so flat as the other leases on the field, and exposed on different parts of it are basalt, black soil, sandstone, and "billy," with slate close to the surface on the south side.

Bathampton Creek runs through the property near the western boundary, and close to the same boundary Yankee Creek and the "Washpool" junctions with Bathampton Creek. The surface features and the position of the shafts are shown on Plate 6.

In sinking the main shaft (4 feet by 4 feet) the coal was struck at seventy feet from the surface, and the floor is sixteen feet below this. The floor is a fire-clay, hard and soft in places with a blue shale below. Beneath the shale is a sandstone.† The coal has a band four inches thick (shown as eighteen inches in Fig. 6) in about the middle of the seam, but it is not known whether this is only local or whether it extends some distance.

The air-shaft was sunk below the coal seam, and four feet below struck a slate formation with vertical beds, and which was penetrated sixteen feet for water. The following section shows the position of the two shafts and the strata passed through:—

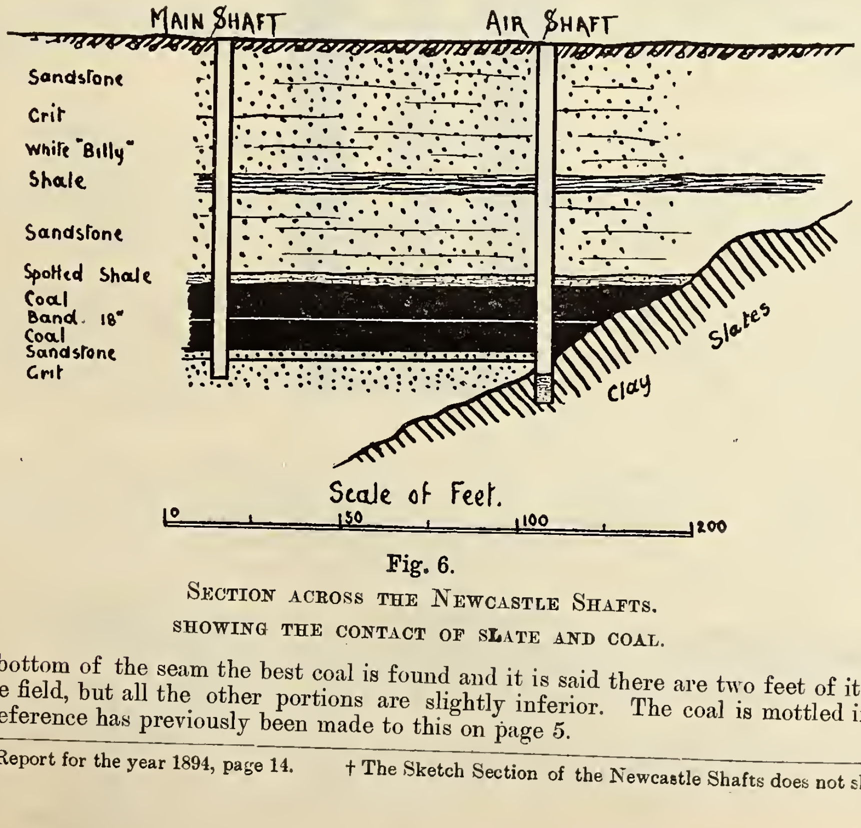


Fig. 6.

Section across the Newcastle Shafts.

showing the contact of slate and coal.

At the bottom of the seam the best coal is found and it is said there are two feet of it equal to the best coal on the field, but all the other portions are slightly inferior. The coal is mottled in some parts of the seam; reference has previously been made to this on page 5.

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* Progress Report for the year 1894, page 14.

† The Sketch Section of the Newcastle Shafts does not show this.

The fossil fern *Glossopteris* together with *Phyllotheca* occurs here in the shales, sandstones, and coal, as in some of the other shafts on the coalfield, and a limestone is reported to occur below the coal seam, of which there is evidence on the surface, as limestone pieces are to be found in the débris around the shaft.

A drive connects the main shaft to the air shaft, and from here a trial sample of 50 tons was taken in February, 1896, and another similar quantity in August, and submitted to the Railway Department for report. Since then no work has been done on the mine. The quality of the coal is apparently very similar to that of Mercer's coal, the analysis of which is given on page 12.

BASTET'S SHAFT.

Bastet's Lease, M.L. 36, of 160 acres, is situated to the north of the leasehold block of Blair Athol. The surface is a sandy soil with outcrops of "billy."

The shaft at eighty feet penetrated a band of coal, and at ninety feet came on a seam of coal ten feet thick. The floor of the coal is shale.

The quality of the coal, as shown from the analysis, is better than what might be expected from the appearance. The coal is not bright, like the Imbell coal for instance, but is rather dull like the coal from Mercer's Shaft.

The analysis shows a low percentage of ash and a higher percentage of fixed carbon than the coal from the other mines. A bulk sample has been submitted to the Railway Department, and it will be interesting to know what the result of the test will be. It will not be a very flaming coal, but should be very suitable for locomotive requirements.*

MERCER'S SHAFT.

The position of Mercer and party's Lease, M.L. 32, of 240 acres, is to the west of the Newcastle and Blair Athol Leases. The surface features are similar to those of Blair Athol, having basalt on one portion and sandstone or sandy soil on the other, with "billy" occurring in one isolated spot.

The shaft is a small prospecting one (5 feet by 2 feet), the depth from the surface to the top of the coal being about 112 feet, and to the bottom, which is on the floor of the coal, about 122 feet, this giving ten feet of a coal seam. Coal also occurs in the shaly rock on the roof, and the change from shale and shaly coal to good coal is gradual.

The quality of the coal from this shaft may be gauged from the analysis on page 12. This shows a rather high percentage of ash, but the coal is higher in fixed carbon than the Imbell coal.

Bulk samples of this coal have been sent to the Railway Department to test, but the result has not yet come to hand.

OTHER LOCALITIES.

WILSON'S WELL.—The coal found here is very bright, but very little work has been done on it as the ground is included in the Carriers' Reserve, and a lease in consequence cannot be granted. Plate 2 will show the depth and altitude of the coal, and Plate 6 will show the position of the shaft with regard to the other leases.

OLD BLAIR ATHOL WELL.—In this well, which is in the freehold block of Blair Athol, the coal was first found. No record can be traced of the strata penetrated, but the depth of the coal is shown on Plate 2, and the position of the shaft on Plate 6.

THE OLD SHAFT EAST OF BLAIR ATHOL, THE ENTERPRISE SHAFT, QUARRY HILL SHAFT, HURLEY'S DIGGINGS, BLACK RIDGE, and MCDONALD'S FLAT are places referred to in the preceding pages, and do not require special mention from a coal-bearing point of view.

SITES FOR FUTURE PROSPECTING OPERATIONS FOR COAL.

In case future contingencies demand that prospecting operations be conducted on parts of the field not now opened up, perhaps positions ought to be shown where such work should be carried out.

The area of country covered by basalt at Blair Athol and the Black Ridge on the Drummond Range should receive some consideration.

Everything indicates the extension of the Measures under the basalt here, and no outcrops of slate or other old rocks are to be seen to indicate the coal formation to be shallow. In about the centre of Bathampton (P.P. 79) the surface rock is basalt, but all around everything shows the Coal Measures to exist below, and to find coal here would considerably extend the area where coal is at present known.

To the west of the Hope would also be a good position for prospecting, as there is very little doubt the coal will be found below the basalt there.

Perhaps the most important site for future prospecting operations would be the centre of the Blair Athol Coal Field. The Coal Measures have not been prospected in depth, and if other coal seams were discovered below those already known the importance of the field would be considerably enhanced. The Eldorado Shaft, or the corner of the Hope and Eldorado Leases where they join the Blair Athol Lease, would be a good position for sinking, and the best method would be by boring with a diamond drill.

As the total thickness of the Coal Measures would not be more than 500 feet that could be taken as the maximum depth required to be prospected, but at the same time the fact must not be overlooked that the slates when tilted have a tendency to form high peaks and deep depressions, and very probably the slate bottom on which the Coal Measures were laid will be very irregular.

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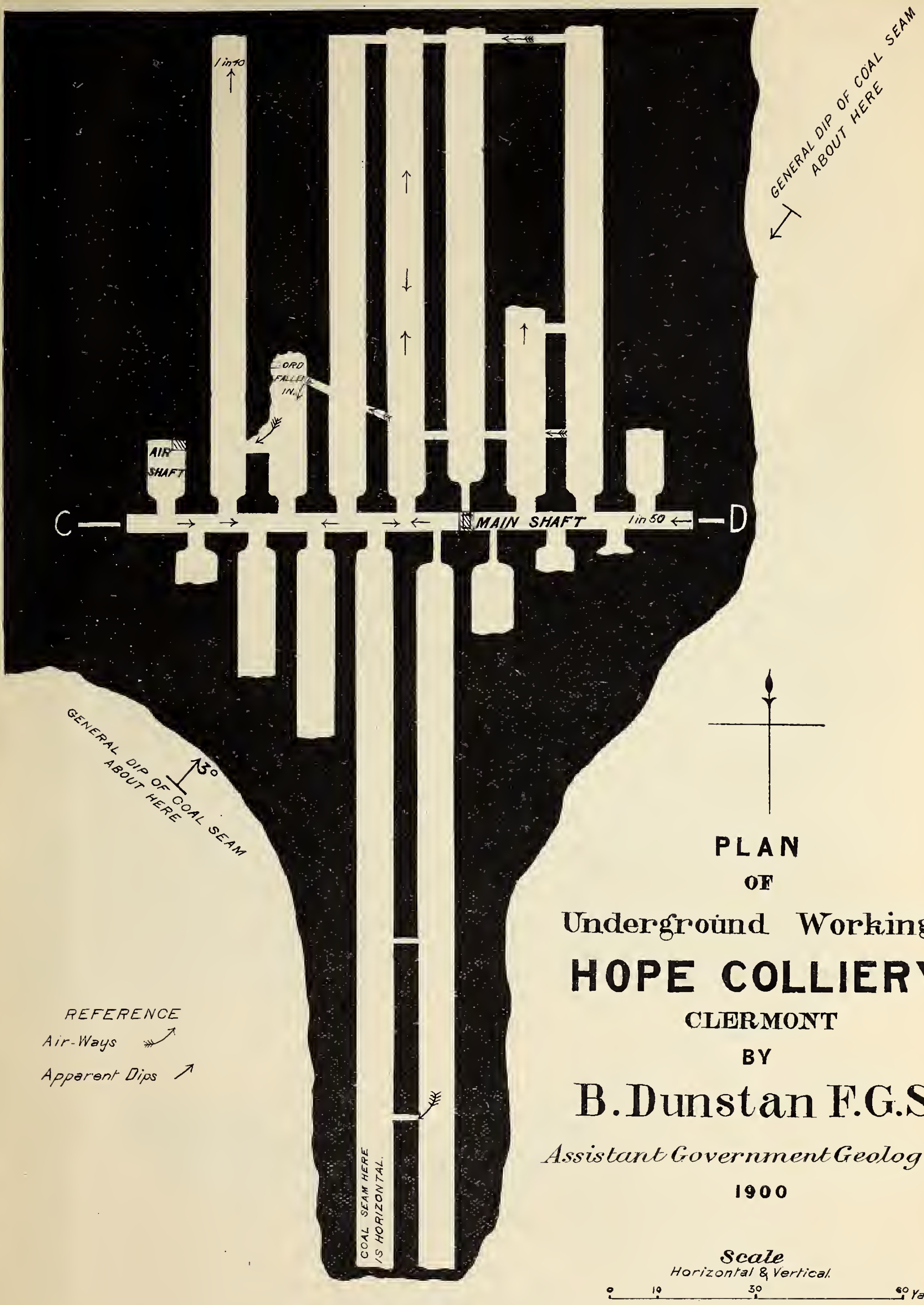
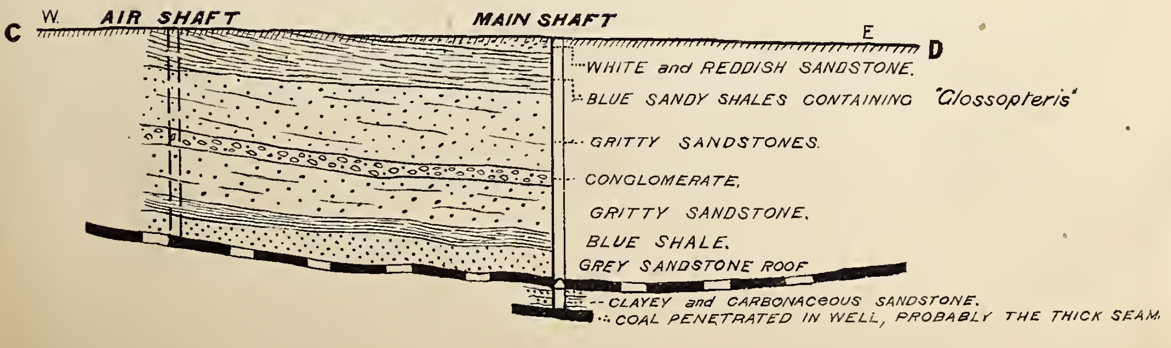
* No tests have been made to determine the calorific powers of these coals, but such determinations would be of importance in showing the amount of mechanical energy they are capable of producing.



PLAN
OF
Underground Workings
HOPE COLLIERY
CLERMONT
BY
B. Dunstan F.G.S.
Assistant Government Geologist.
1900

Section on line CD
From Surface


C
W.
AIR SHAFT
MAIN SHAFT
E
D
WHITE and REDDISH SANDSTONE.
BLUE SANDY SHALES CONTAINING "Glossopteris"
GRITTY SANDSTONES.
CONGLOMERATE.
GRITTY SANDSTONE.
BLUE SHALE.
GREY SANDSTONE ROOF
CLAYEY and CARBONACEOUS SANDSTONE.
COAL PENETRATED IN WELL, PROBABLY THE THICK SEAM.

LEONARD C. GREEN, Del.

GOLD DEPOSITS IN THE COAL MEASURES.

From a perusal of the accompanying Geological Map of the Clermont District, it will be seen that the Coal Measures at Blair Athol are covered by basalt on the northern side. It is not known what relation the Coal Measures bear to the older rocks in this direction, but on all other sides auriferous slates and schists outcrop on the surface and surround the Coal Measures. It may be taken for granted, then, that much of the material derived from the disintegration of the older rocks have in the past gone to form the rocks of which the Coal Measures are comprised, and also that any gold contained in the older formation might be carried to form auriferous deposits in the younger one, although it must be borne in mind that in the transfer of the gold from one formation to the other, it does not follow as a result that the gold is *concentrated* by the operation.

Considering the Measures from an auriferous point of view, there is no probability of the gold occurring in a bed or series of beds throughout the field in a manner similar to the coal, but there might have been streams entering the old freshwater lake or lagoon or swamp bringing gold into channels now hidden by more recent accumulations, and future developments might lead to the discovery of some of these old gold leads below the coal seams. It is quite within the range of possibility that some of the shafts now utilised for coal-mining purposes might in future be used for prospecting the Coal Measures in depth for alluvial gold.

The coal itself has given indications of the presence of gold in the "ash," although only in traces, but the samples tested by the Government Analyst were only a few in number, and much requires to be done before the matter is settled as to the occurrence of gold in the coal in payable quantities.

The scope of the present inspection of the coalfield did not permit of special attention being paid to the subject, but it might be suggested to those interested in the Blair Athol Coal Mines that the presence of gold in the "ash" of the coal is a subject which should be investigated from a commercial point of view.

On the outskirts of the coalfield the Measures are more confined, and so the deposits there carrying the gold are limited in extent. Some of the deposits are very rich in gold, and in some cases coal bands and shales containing *Glossopteris*—the Coal Measure fossil fern—have been sunk through before the gold is obtained.

At The Springs, to the north of Clermont, the gold is found under varying conditions, but the section across one of the leads on page 6, Fig. 3, shows its usual mode of occurrence. Mr. Rands has found *Glossopteris* in the alluvial workings in abundance, and the character of the formation is similar in many respects to that at Blair Athol in which the coal occurs.

At the Black Ridge to the north-west of The Springs, the gold is found some depth below a band of inferior coal and on a bottom of slate. (See Fig. 6, page 15.)

At the Wild Cat Lead to the south-east of Clermont, a recent "wash" occurs above a dolerite, and below the dolerite the Coal Measure gold "lead" is to be found resting on slates and schists.

In the section illustrating the leads at Wild Cat, on page 7, Fig. 4, the dolerite is shown worn into channels and in which the "wash" has accumulated. This might be quite true, but there is a possibility that the dolerite filled pre-existing channels in the Coal Measures, and that instead of the deposits at the sides of the dolerite, as shown in the sketch, being recent accumulations they themselves might be the old sides of the channels along which the dolerite flowed.

At Hurley's Diggings the alluvial deposits have not been tested below the places where the coal bands have been found, but gold has been found in deposits that apparently are Coal Measures. The section in Fig. 7 is taken across a watercourse where the gold is found in the new wash, and from the indications all around it is probable that the gold will be found below the coal if sinking were to be continued.

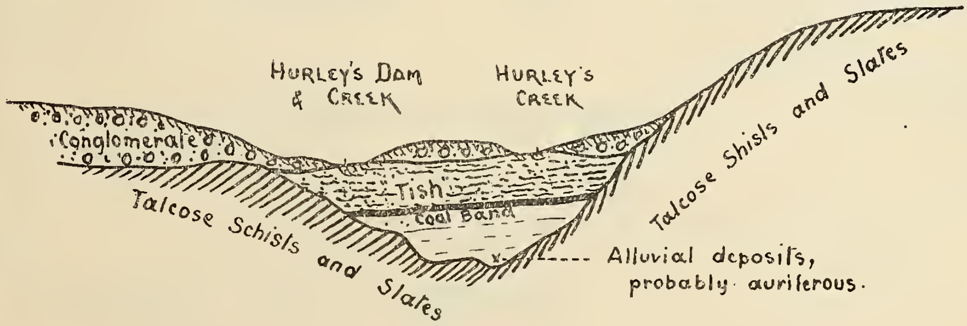

HURLEY'S DAM & CREEK
HURLEY'S CREEK
Conglomerate
Tish
Coal Band
Talcose Schists and Slates
Talcose Shists and Slates
Alluvial deposits, probably auriferous.

Fig. 7.

SECTION ACROSS HURLEY'S DIGGINGS.

A COAL BAND PROBABLY COVERING AN AURIFEROUS DEPOSIT.

NOTE ON THE EXAMINATION OF GOLD DEPOSITS.

The recent geological work was undertaken more to place on record all information regarding the Coal Measures rather than for the purpose of giving a description of the gold deposits, so attention has not been paid to the latter except where they are associated with coal-bearing beds. From what has been seen concerning them, however, a large amount of useful information waits to be accumulated from those now engaged in gold-mining, which could be well utilised in defining the position of not so much the "leads" of gold where they are now being worked, but their probable extension into the ground not at present opened. The Springs and the Wild Cat may be mentioned as localities where such information would prove extremely useful in helping to follow the rich gold deposits that have been found there in the past. At the latter place the gold drifts have proved very rich right down to the spot where operations have ceased, and the prospecting work done to pick up this lead has been carried on in anything but a methodical manner. Had a systematic geological examination been instituted, expenditure of money might have been avoided in some cases, and ground that is not opened at all might now be yielding good returns of gold.

Petrological Notes on the Dolerites of Wild Cat and The Springs.

Occurrence.—The specimen of dolerite from The Springs was taken from a shaft near the All Nations Lead, and is the dolerite shown above the deposit containing the white "billy," in Fig. 3, on page 6. The specimen from the Wild Cat is the dolerite represented in Fig. 4, on page 7, and was taken from a shaft which was abandoned because it was thought useless to expect gold deposits to occur below it.

Macroscopic Characters.—Both rocks are hard and compact, without any decomposition showing except in cracks and joints; fracture is irregular and jagged; no cavities or amygdules; no porphyritic constituents; lustre in both cases glimmering; colour bluish-black with traces of greenish clayey substance in the joints. In the specimen from The Springs a white clay is also present in traces in the cracks of the rock.

Microscopic Characters.—*Wild Cat.*—Base, occasionally semi-vitreous but usually devitrified; olivine, almost colourless, decomposed on borders and in cracks to form serpentine; felspar, idiomorphic, lath-shaped; augite, ophitic with optic orientation marked, crystallised boundaries rare, cleavage rare; magnetite, as inclusions in all the minerals in the section but rare in the olivine; apatite microliths as inclusions in the felspar and augite in such abundance as to give a character to the rock, but absent from the olivine; glassy inclusions occur with the magnetite in the olivine and felspar.

The Springs.—Base, semi-vitreous, with a development of spherulitic structure common; olivine, partly decomposed to serpentine, but crystalline form preserved; felspar, idiomorphic, with polysynthetic twinning; augite, ophitic, cleavage absent, colour brown; magnetite, not crystallised, in irregular patches and blades along the sides of the felspar crystals; apatite, as inclusions common, but not in such abundance as in the dolerite of Wild Cat; glassy inclusions in felspar and augite.

A rough estimate of the proportion of the principal minerals and basic matter in the two specimens yielded the following results:—

	Wild Cat.	The Springs.
Olivine	14	12
Felspar	40	30
Augite	20	30
Magnetite	6	3
Base	20	30

The above shows a variation in mineral composition and a variation in the proportion of chemical substances, but in the individualised portions of the rock the amount of silica in proportion to the basic constituents would be about the same in each specimen.

TABLE OF ALTITUDES OF LOCALITIES REFERRED TO.

	Feet above sea-level (approx.)		Feet above sea-level (approx.)
Cement Hill	1,090	Old Shaft South of Eldorado ...	1,075
Springs Hotel	1,066	Wilson's Well	1,070
Gowrie Creek (at The Springs) ...	1,026	Newcastle Shaft	1,120
Bastet's Shaft	1,130	Mercer's Shaft	1,080
Old Blair Athol Well	1,120	Venus Hotel	916
Blair Athol Shaft	1,092	Quarry Hill Shaft	940
Hope Shaft	1,115	Enterprise Shaft	890
Eldorado Shaft	1,095	Railway Reserve	936
Imbell Shaft	1,105	Clermont (Lagoon)	880

Brisbane, March 30th, 1900.

No. 148 of the Geological Survey Publications.

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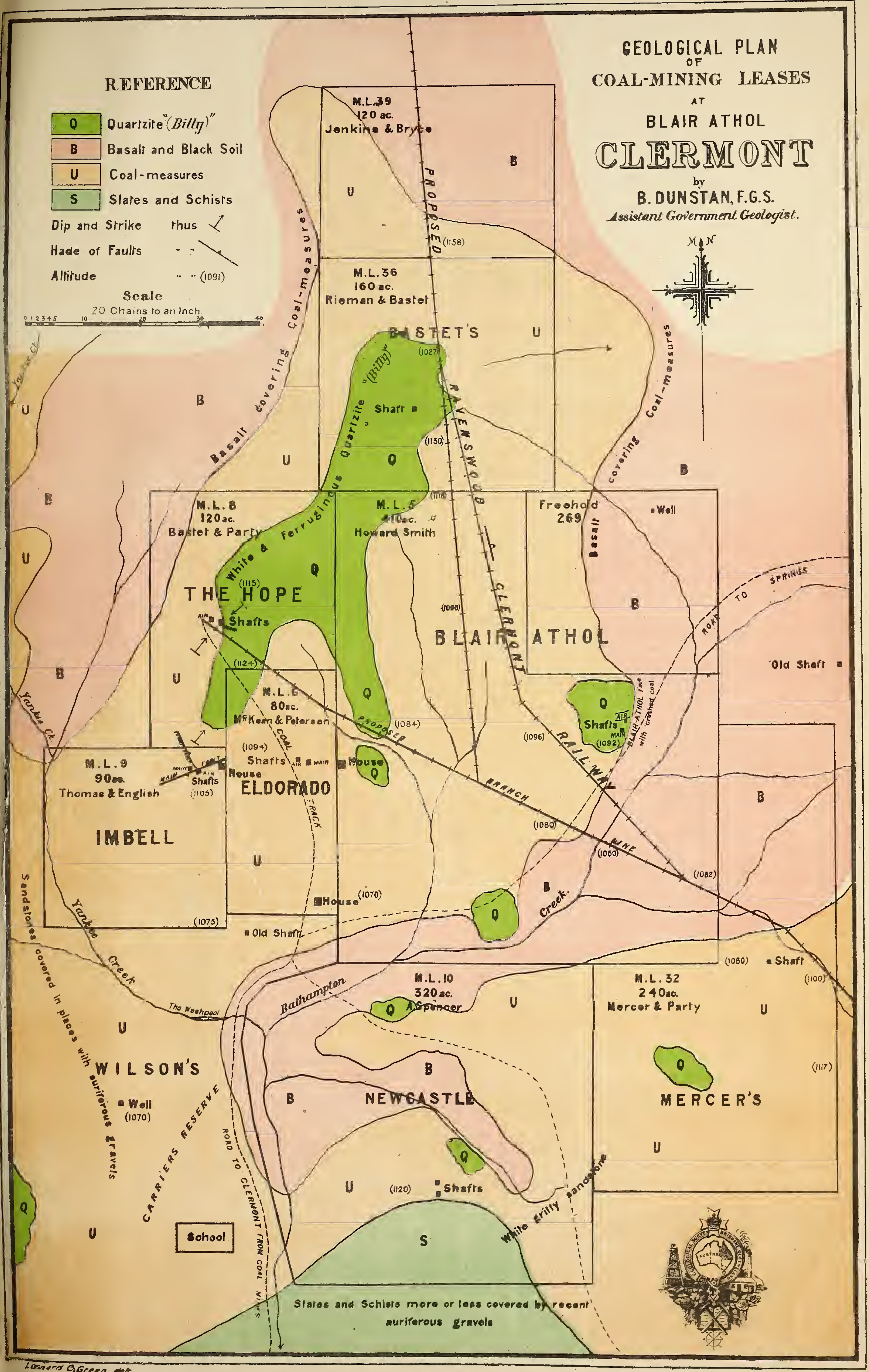
GEOLOGICAL SURVEY OF QUEENSLAND.

Plate VI



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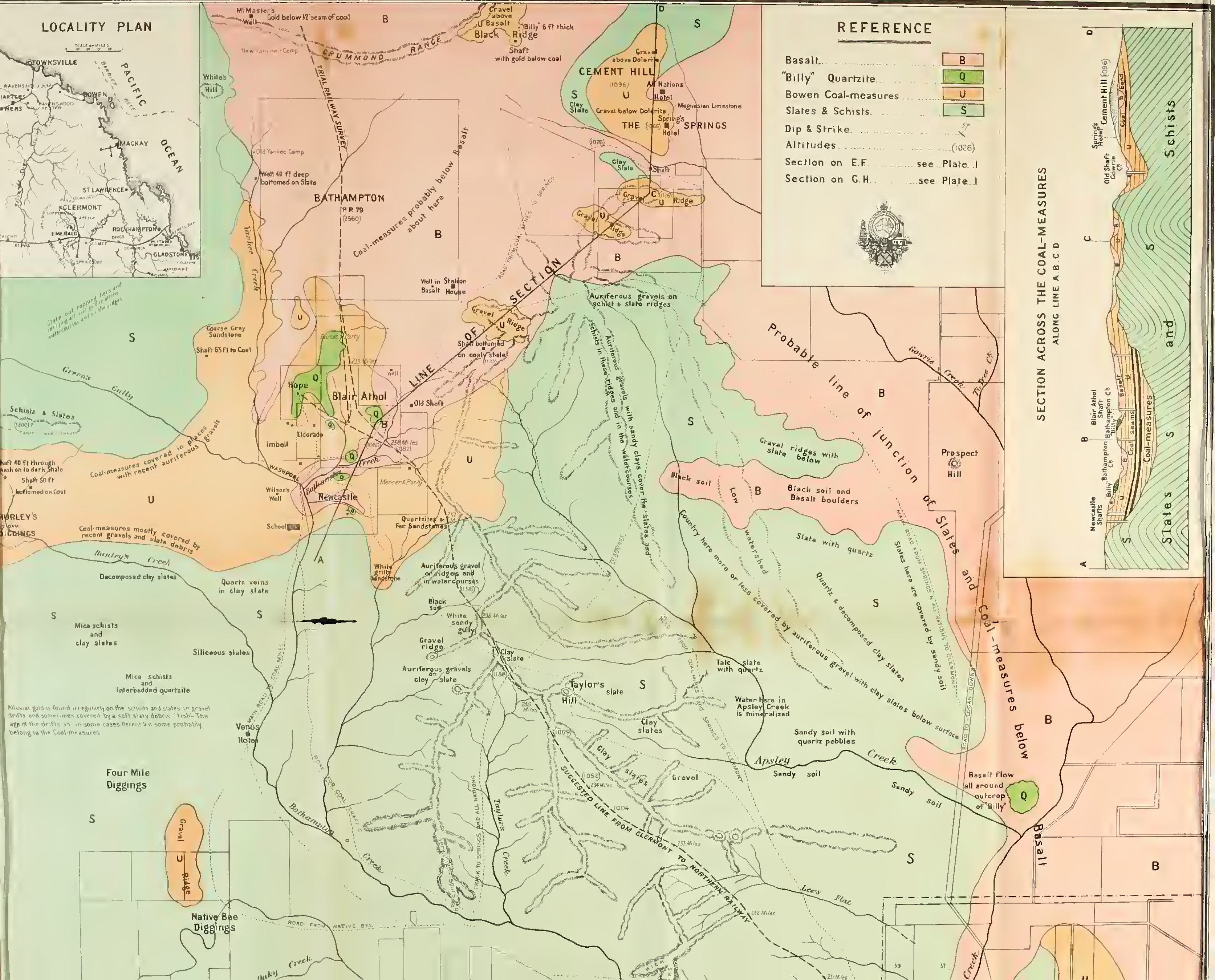
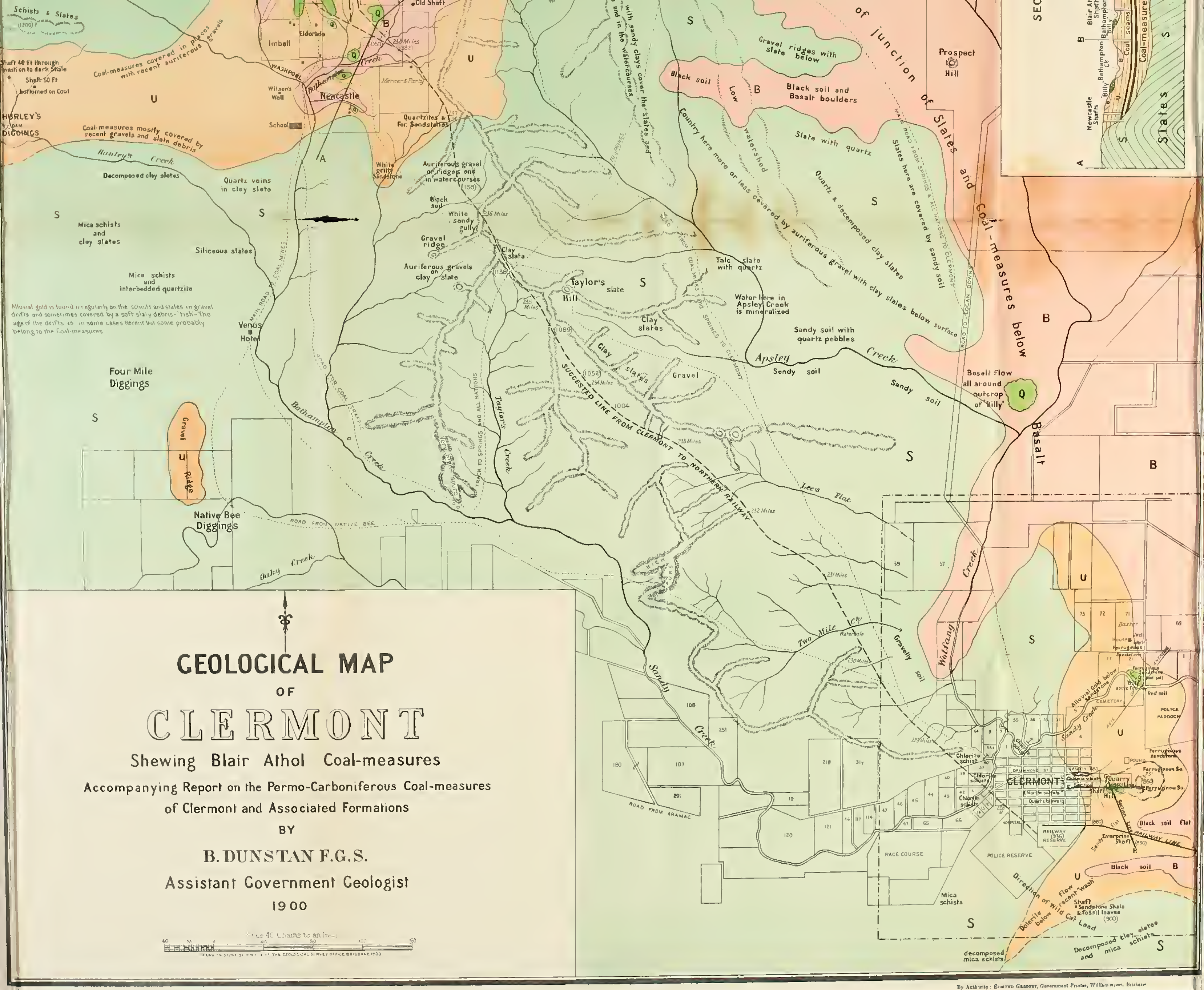
EOLOGICAL SURVEY OF QUEENSLAND

WILLIAM H. RANDS GOVERNMENT GEOLOGIST


LOCALITY PLAN
TOWNSVILLE
PACIFIC
OCEAN
BOWEN
MACKAY
ST LAWRENCE
CLERMONT
ROCKHAMPTON
EMERALD
GLADSTONE
REFERENCE
Basalt B
"Billy" Quartzite Q
Bowen Coal-measures U
Slates & Schists S
Dip & Strike
Altitudes (1026)
Section on E.F. see Plate I
Section on G.H. see Plate I
SECTION ACROSS THE COAL-MEASURES
ALONG LINE A.B.C.D
Cement Hill (1096)
Springs Hotel
Old Shaft Gowrie Ck
Blair Athol Shaft
Bathampton Ck
Newcastle Shafts
Coal seams
Coal-measures
Slates and Schists
McMaster's Well
Gold below 12' seam of coal
Gravel above Basalt
Billy 6 ft thick
Black Ridge
Shaft with gold below coal
DRUMMOND RANGE
New Zealand Camp
TRIAL RAILWAY SURVEY
White's Hill
Old Yankee Camp
Well 40 ft deep bottomed on Slate
BATHAMPTON
P.P. 79 (2560)
Coal-measures probably below Basalt about here
CEMENT HILL (1096)
Gravel above Dolerite
All Nations Hotel
Magnesian Limestone
Clay Slate
Gravel below Dolerite
THE SPRINGS
Springs Hotel
Clay Slate
Shaft
Gravel U Ridge
Well in Station Basalt House
LINE OF SECTION
Yankee Creek
Slate out cropping here and carrying all the gold in all the watercourses out on the ridges
Coarse Grey Sandstone
Shaft 63 ft to Coal
Greens Gully
Schists & Slates (1200)
Shaft bottomed on coaly shale (1120)
Auriferous gravels on schist & slate ridges
Schists in these ridges and in the watercourses
Auriferous gravels with sandy clays cover the slates and
Probable line of junction of Slates and Coal-measures below Basalt
Gowrie Creek
Ti-Tree Ck
Prospect Hill
Hope
Blair Athol
Old Shaft
Imbell
Eldorado
238 Miles (1082)
Washpool Creek
Mercer & Party
Bathampton
Wilson's Well
Newcastle
School
Quartzites & Fer. Sandstones
Shaft 40 ft through wash on to dark Shale
Shaft 50 ft bottomed on Coal
Coal-measures covered in places with recent auriferous gravels
Coal-measures mostly covered by recent gravels and slate debris
Hurley's Creek
Gravel ridges with slate below
Black soil
Low watershed
Black soil and Basalt boulders
Country here more or less covered by auriferous gravel with clay slates below surface
Slate with quartz
Quartz & decomposed clay slates
Slates here are covered by sandy soil
MAIN ROAD FROM SPRINGS & ALL NATIONS TO CLERMONT
ROAD TO LOGAN DOWNS
Decomposed clay slates
Quartz veins in clay slate
White grit Sandstone
Auriferous gravel on ridges and in watercourses (1158)
Black soil
White sandy gully
236 Miles
Mica schists and clay slates
Siliceous slates
Gravel ridges
Clay Slate
Auriferous gravels on clay slate (1138)
Mica schists and interbedded quartzite
Taylor's Hill
Talc slate with quartz
Water here in Apsley Creek is mineralized
Alluvial gold is found irregularly on the schists and slates in gravel drifts and sometimes covered by a soft slaty debris "fish". The age of the drifts is in some cases Recent but some probably belong to the Coal-measures
Venus Hotel
MAIN ROAD TO COAL MINES
(1089)
Clay slates
Sandy soil with quartz pebbles
Apsley Creek
Sandy soil
Basalt flow all around outcrop of "Billy"
Four Mile Diggings
(1052) 234 Miles
SUGGESTED LINE FROM CLERMONT TO NORTHERN RAILWAY
Gravel
1004
Bathampton Creek
Taylor's Creek
TRACK TO SPRINGS AND ALL NATIONS
233 Miles
Lee's Flat
232 Miles
Gravel U Ridge
Native Bee Diggings
ROAD FROM NATIVE BEE
Oaky Creek
231 Miles
Creek
A
B
C
D
S
U
Q


Schists & Slates
Old Shaft
Imbell
Eldorado
Shaft 40 ft through wash on to dark Shale
Shaft 50 ft bottomed on Coal
Coal-measures covered in places with recent auriferous gravels
HURLEY'S DIGGINGS
Wilson's Well
Washpool
Bathampton
Newcastle
Creek
Mercer & Party
School
Quartzites & Fer. Sandstones
Coal-measures mostly covered by recent gravels and slate debris
Hurley's Creek
Decomposed clay slates
Quartz veins in clay slate
White grit Sandstone
Auriferous gravel on ridges and in watercourses
Mica schists and clay slates
Siliceous slates
Mica schists and interbedded quartzite
Alluvial gold is found irregularly on the schists and slates in gravel drifts and sometimes covered by a soft slaty debris-"fish". The age of the drifts is in some cases Recent but some probably belong to the Coal-measures
Venus Hotel
Main Road to Coal Mines
Four Mile Diggings
Gravel Ridge
Native Bee Diggings
Road from Native Bee
Oaky Creek
Black soil
White sandy gully
Gravel ridge
Clay slate
Auriferous gravels on clay slate
Taylor's Hill
slate
Clay slates
Clay slates
Gravel
Road for Coal Traffic
Track to Springs and All Nations
Taylor's Creek
Bathampton Creek
Suggested Line from Clermont to Northern Railway
with sandy clays cover the slates and in the watercourses
Low watershed
Black soil
Black soil and Basalt boulders
Gravel ridges with slate below
Country here more or less covered by auriferous gravel with clay slates below surface
Slate with quartz
Quartz & decomposed clay slates
Slates here are covered by sandy soil
Main Road from Springs & All Nations to Clermont
Road to Logan Downs
Line of junction of Slates and Coal-measures below
Prospect Hill
Talc slate with quartz
Water here in Apsley Creek is mineralized
Sandy soil with quartz pebbles
Apsley Creek
Sandy soil
Sandy soil
Basalt flow all around outcrop of "Billy"
Basalt
Lees Flat
Two Mile Ck
Waterhole
Gravelly soil
Wolfang Creek
Sandy Creek
Road from Aramac
Race Course
Police Reserve
Railway Reserve
Chlorite schist
Chlorite schists
Quartz blows
CLERMONT
Cemetery
Alluvial gold below sandstone
Ferruginous Sandstone
Red soil
Police Paddock
Quarry Hill
Enterprise Shaft
Black soil flat
Railway Line
Shaft Sandstone Shale & fossil leaves
Direction of Wild Cat Lead
Dolerite flow below recent wash
Black soil
Mica schists
decomposed mica schists
Decomposed clay slates and mica schists
Slates
Coal seams
Coal-measures
Newcastle Shafts
Bathampton
Billy
Blair Athol Shafts
SEC

GEOLOGICAL MAP

OF

CLERMONT

Shewing Blair Athol Coal-measures

Accompanying Report on the Permo-Carboniferous Coal-measures
of Clermont and Associated Formations

BY

B. DUNSTAN F.G.S.

Assistant Government Geologist

1900

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